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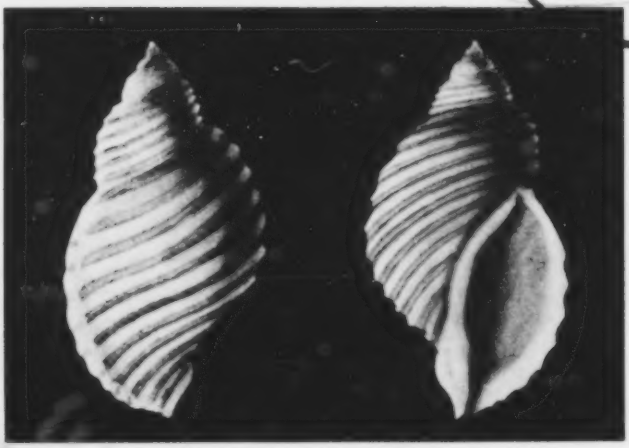

The Intertidal Univalves of British Columbia

By LELA M. GRIFFITH
Egmont, B.C.

Illustrations by Frank L. Beebe

VICTORIA, B.C. MARCH, 1967

THE HONOURABLE WILLIAM KENNETH KIERNAN
Minister

D. B. TURNER
Deputy Minister

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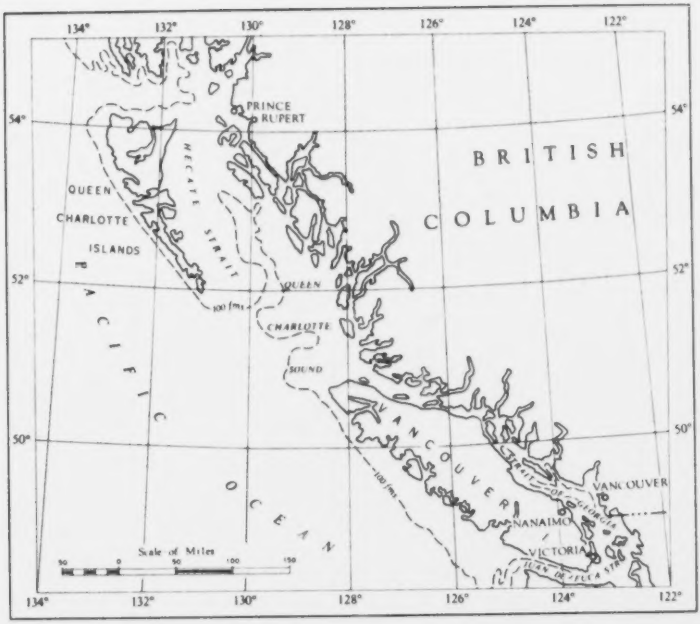
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STRAIT OF GEORGIA
VANCOUVER
NANAIMO
VICTORIA
JUAN DE FUCA STR.
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Intertidal Univalves of British Columbia

INTRODUCTION

At one time or another, most of us have gathered a few sea shells from a sandy beach or picked them up on a rocky shore; perhaps carried them home to admire. We may have wondered what they were; called them "clams," "mussels," or "periwinkles"; possibly attempted to find them in a book devoted to shells of this coast, but too few of our British Columbia species have been included in such works as are available to the average person. To help fill the need for a more satisfactory source of information, this handbook, dealing particularly with the marine snails, univalves or gastropods, has been prepared.

These creatures belong to the phylum *Mollusca,* a very large group of animals with unsegmented bodies usually encased in a calcareous shell or shells. In gastropods the shell is single and is usually spiral, but in some groups, such as the limpets (*Acmæa*), it is spiral-shaped only in the embryo and becomes conical in the adult. The shell is most commonly borne on the back, but sometimes it is internal, as in our garden slugs, or absent entirely in the adult, as in the beautiful nudibranchs or sea slugs.

No group of animals is more widely distributed than the Gastropoda. Some species may be found from the tops of the highest mountains to the depths of the sea; some spend their lives in trees; some crawl around our gardens and by the roadsides; some live in lakes or streams; some in the brackish water of estuaries; some prefer the area between high and low water where they are submerged only part of the time; others inhabit the deeper water; and still others are pelagic, drifting to and fro with the ocean currents on or just beneath the surface. Only to the driest parts of the desert have they failed to become adjusted.

This booklet deals only with those snails which make their home between high and low tide on the coast of British Columbia.

STRUCTURE

The snail within the shell has a distinct head and a broad flat foot. The head bears one or two pairs of tentacles, a pair of eyes, and a mouth. Inside the mouth is a ribbon-like organ called the radula, set with rows of horny teeth used to rasp off particles of food. These teeth are in regular patterns and serve as one means of distinguishing between various groups of snails. The foot forms the ventral surface of the body and is used for creeping or for clinging; occasionally it is modified for swimming. To the posterior end is often attached an operculum or "door," which securely closes the aperture when the snail withdraws into its shell. The operculum may be horny or calcareous, and the substance and form are usually typical of a genus.

The shell is secreted by a mantle which hangs from the dorsal side of the body and partially envelopes it. The shell is composed of three layers: the inner one (mother-of-pearl) is secreted by the whole mantle; the middle layer and the outer layer (periostracum) are formed by the edge of the mantle. As the animal grows, the shell is enlarged by adding continually to its outer lip.

In colour, shape, and size there is an endless and fascinating variety: from the little brown snail of our lakes to the rainbow-hued tree snails of the tropics; from the smooth round moonsnail to the beautiful murexes with arrays of spines and varices; from the infinitesimal *Melanella* to the huge bailer-shell (*Melo diadema*) used by the aborigines of the Pacific for a canoe-bailer and water-container. Most snails are coiled from the right and are said to be dextral, but quite a number, especially land and fresh-water species, coil from the left and are sinistral. A few species have both dextral and sinistral forms.

NATURAL HISTORY

Some gastropods are herbivorous and some are carnivorous, and members of both groups can be great pests. We are all too familiar with the slimy garden slug, which is with us in various sizes according to species and all hungry for seedlings and soft-leaved plants. In some places, such as California, shell-bearing land snails

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are just as destructive; efforts are made to eradicate them, and precautions are now being taken to avoid importing more from the Far East. Among the predaceous marine snails we have two oyster drills (*Urosalpinx cinerea* and *Ocenebra japonica*), brought with oyster spat from the Atlantic Coast and from Japan respectively, and they do damage on the oyster beds. The big moon-snail (*Polinices lewisii*) is very fond of clams and has been known to multiply to such an extent that it nearly eliminated the clam population on a beach. There are other lesser offenders which prey upon small bivalves and upon each other. In each instance the predator drills a neat round hole with its radula in the victim's shell and rasps the animal out.

Marine gastropods usually have the sexes separate, but land snails are hermaphroditic, having both male and female organs in each individual. All gastropods produce eggs, although a number are viviparous; that is, they bear live young, these having emerged from the egg within the parent. In some cases, where eggs are laid before hatching, fertilization takes place in the water; in others the eggs are fertilized within the female. Because the mortality rate is extremely high, the eggs are laid in very large numbers, often in special protective cases. Their form varies greatly, and many kinds can be observed on the beaches. The most striking is probably the " sand collar " of the moon-snail (*Polinices lewisii*), that circular rubbery collar of sand containing embedded eggs too minute to see and all cemented together with a mucous secretion. Under rocks or on piling may be found " sea corn "—egg capsules of the Oregon triton (*Fusitriton oregonensis*) like little kernels of corn. They are laid one by one as the snail moves round and round in an ever-widening circle. The *Thais* egg capsules are similar but are more slender and vase-shaped, with flat round tops. Those of *Ceratostoma* are like rolled leaves deposited on rocks, or sometimes on their own shells.

In each capsule are many eggs, and after hatching the stronger larvæ devour the weaker. The survivors escape through a slit in the outer cover. After leaving the capsule, the majority of young gastropods go through a free-swimming stage enclosed in a tiny transparent case, that of the periwinkle (*Littorina littorea*) being

shaped like a microscopic bowler hat enclosing two pairs of even smaller periwinkles. In many cases the embryonic shells are unlike the adult form; they therefore undergo considerable change during metamorphosis. In all cases, including the pelagic forms, the larvæ must find a suitable environment, and must be able to care for themselves within a short time or perish.

USES BY MAN

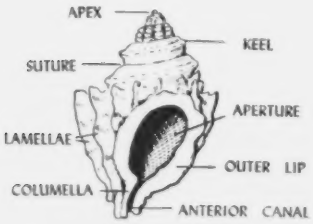
Because of their beauty and sometimes because of their rarity, some kinds of shells are greatly prized by man. Worthy of special mention are the Oriental chank shells (*Turbinella pyrum*), sacred shell of the Hindus. These are brought up by divers in large numbers, and perfect specimens bring very high prices. Most valued are the left-handed chanks, worth their weight in gold, and used as sacred vessels by temple priests. Perhaps better known are the little ivory or yellow money cowries (*Cypræa moneta*), at one time used throughout the Pacific as a medium of exchange and also for personal adornment. The lovely golden cowry (*Cypræa aurantium*) was worn only by a chief as a symbol of his sovereignty. Others of note are the pearly turban (*Turbo petholatus*), whose shiny operculum is called a cat's-eye and is prized as a jewel, and the large Triton's trumpet (*Charonia tritonis*), used by priests in Japan to call the people to worship.

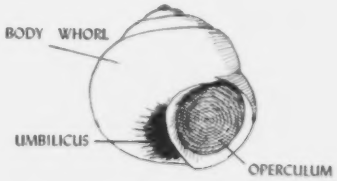
Commercially, too, snails are of interest. In Europe some species of land snails are considered a delicacy, and there are snail farms to supply the demand. In Britain the marine "winkles" (*Littorina littorea* and *Buccinum undatum*) are gathered for the market. In the Bahamas, conch chowder is made from the meat of the Queen conch (*Strombus gigas*). On the California coast and to a lesser extent in British Columbia, men make their living diving for abalone (*Haliotis* species), the broad foot of which is sliced and friend like steak. The shell is also sold and furnishes high-grade mother-of-pearl. Another source of mother-of-pearl for ornaments, buttons, etc., is the large "Trochi" (*Trochus niloticus*) of the South Pacific. In various parts of the world, shells are gathered and sold for the cutting of cameos, particularly the helmet shells

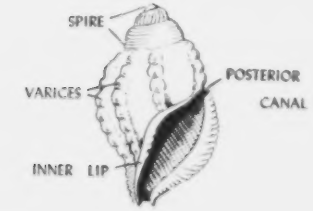
(*Cassis cameo* and *C. cornuta*) and the Queen conch, referred to above.

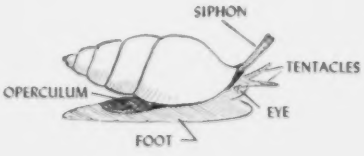
IDENTIFICATION

In the classification of gastropods, as with other animals, scientists considered the type and arrangement of the body organs when grouping the snails into orders, suborders, and tribes. Usually, however, we must depend on the characteristics of the shell alone when identifying our specimens. The general shape of the shell, number of whorls, shape and size of aperture, open or closed umbilicus, length of canal, presence or absence of an operculum, type of the latter are all points to consider when determining the genus and species of any given shell (*see* Figs. 1, 2, 3, and 4). Each when properly identified will bear two names—first the genus and following that the species. After the species is written the name of the authority, the person who first named the species. When the name of the authority is in parentheses, it means the generic name has been changed.









A key to the families of snails likely to be found between tides along the British Columbia coast follows this section. Once the family is determined, it should be relatively simple to identify the specimen in question by comparing it with the illustrations and descriptions given under each family heading.

In this handbook the families are arranged according to Pelseneer. It will be noticed that in some works a slightly different arrangement has been used. This in no way affects the generic and specific identifications.

Besides being of value in identifying the shells of our British Columbia coast, Keep's " West Coast Shells," revised by Joshua L. Bailey, Jr., and "Animals of the Sea-shore," by M. L. Guberlet, provide a wealth of interesting information about the habits and life histories of the animals themselves. Very useful to the beginner, too, are " Sea-shore Animals of the Pacific Coast," by Johnson and Snook, and " Between Pacific Tides," by Ricketts and Calvin. The former describes some species from each phylum represented on our beaches, including gastropods, and the latter arranges all the seashore animals in groups according to their habitat. " The Marine Shells of the North-west Coast of America," by Ida S. Oldroyd, is unsurpassed but it is rather technical. Perhaps of more use to the beginner is the section on molluscs in " Intertidal Invertebrates of the Central California Coast," by S. F. Light and others. For a simple understandable explanation of the reasons back of the various groupings in the phylum *Mollusca,* Dr. Bartsch's section in " Fishes and Shells of the Pacific World," by Bartsch and Nichols, is very good.

SHELL-COLLECTING

Scarcely a beach on the coast is without molluscs, but on the exposed surf-lashed rocks there will be very few. Open gravelly stretches are practically barren and mud flats have few inhabitants. When shell-hunting try the protected sandy bays, the boulders along the edges of the sandy areas, and the sheltered rocky places. High up where the tide seldom reaches are littorines and limpets. Some species of the latter seem to prefer a spot where fresh water seeps over the rocks during most of the year. Lower down in the crevices

are the Margarites, Calliostomas, Cypræolinas, etc. Choose a day when the tide is low, for then you not only have a longer time in which to search, but you have a chance to find the snails which inhabit only those lowest areas uncovered very briefly. Do not neglect to take a digging-fork or clam-digger (a fork with tines at right angles to the handle); live specimens are usually superior to the dead ones lying on top, and some species, such as the *Polinices* and the *Olivellas*, live in the sand. A knife should be carried to pry limpets and other clinging types from the rocks. This operation should be performed with a quick thrust, surprising the victim before it has an opportunity to clamp down, otherwise it is almost impossible to remove it without damaging the shell. Roll rocks but turn them back again as much of the life so revealed will not long survive if left exposed to the light and predators.

To carry your treasures safely home, a bucket or basket should be supplemented by several glass jars or plastic bags in which to keep fragile specimens, and some small bottles with caps or corks for the tiny shells. Lastly, look well at your finds: take only those you are sure you will use and leave the rest to live and reproduce.

Once home, sort your material and clean the outside of each shell with water and a small brush. Bivalves are easily steamed open and the contents removed, but gastropods are more difficult. Drop them into boiling water for about 10 minutes, then into cold; remove and set aside the operculum, and draw the animal gently out, using a hook made by bending a bit of wire. If, in spite of care, the animal breaks, leaving some of the body in the shell, cover with a 5-per-cent solution of formaldehyde for a day or two. Very small snails need not be cleaned; simply treat them with the formaldehyde solution. To remove algæ and other growths and to brighten the shells, immerse them, using tongs, for a few seconds in a 50-per-cent solution of muriatic acid. This is more effective when used hot, but the shells should not be left too long in the acid and they should be rinsed immediately in cold water. The greatest care must be taken to avoid inhaling the acid fumes or getting them into the eyes. Finally, with cotton wool stuff the apertures of those snails which have opercula and mount each little door in place with a drop of glue.

With each lot of shells place a record of the locality in which they were collected, the date, and the name of the collector. Later, when they have been identified, each shell, except the very small ones, should be numbered in India ink with a fine pen. Small specimens may be placed in vials or pillboxes with a number on a slip of paper. The numbers should then be entered in a catalogue in numerical order together with the collection data for each shell or for each lot. A catalogue will prove to be invaluable; it provides a permanent record of your collections and makes it possible to return specimens and labels to their proper places if they get mixed up.

Identified shells can be stored in trays or drawers, preferably in some type of cabinet. It is customary to group the specimens in families and to arrange the families in systematic order.

KEY TO THE FAMILIES OF INTERTIDAL GASTROPODS OF BRITISH COLUMBIA

			PAGE
1.	(10)	Shell with no coiled spire; cone, or cap-shaped—2.	
2.	(3)	With opening at apex—family *Fissurellidæ*	23
3.	(2)	With no opening at apex—4.	
4.	(9)	With no internal deck or shelf—5.	
5.	(8)	Shell smooth or radially ridged—6.	
6.	(7)	Siphonal groove from apex to margin—family *Siphonariidæ*	92
7.	(6)	No siphonal groove—family *Acmæidæ*	15
8.	(5)	Shell ridged, concentrically laminate—family *Hipponicidæ*	47
9.	(4)	With internal deck—family *Calyptræidæ*	49
10.	(1)	Shell with coiled spire—11.	
11.	(14)	Spire not visible, shell rolled—12.	
12.	(13)	Loosely coiled, aperture wide—family *Bullidæ*	90
13.	(12)	Tightly coiled, aperture narrow—family *Marginellidæ*	85
14.	(11)	Spire visible—15.	
15.	(18)	Spire flattened and shell limpet-like—16.	
16.	(17)	With several open holes—family *Haliotidæ*	21
17.	(16)	With no holes—family *Lamellariidæ*	57
18.	(15)	Spire not flattened, more or less extended—19.	
19.	(36)	Canal absent (i.e., margin of aperture entire)—20.	
20.	(21)	Shell globular—family *Naticidæ*	53
21.	(20)	Shell not globular—22.	
22.	(25)	Shell top-shaped, base fairly flat—23.	
23.	(24)	Operculum horny—family *Trochidæ*	26
24.	(23)	Operculum calcareous—family *Turbinidæ*	35
25.	(22)	Shell plump, spire acute—26.	
26.	(33)	Aperture half length of shell or longer—27.	
27.	(30)	Aperture about half length of shell—28.	
28.	(29)	Periostricum thin or wanting—family *Littorinidæ*	38
29.	(28)	Periostricum shaggy—family *Fossaridæ*	43
30.	(27)	Aperture more than half length of shell, spire short—31.	
31.	(32)	Operculum present—family *Acteonidæ*	86
32.	(31)	Operculum absent—family *Scaphandridæ*	89
33.	(26)	Aperture less than half length of shell, spire extended—34.	
34.	(35)	Shell dull, calcareous—family *Pyramidellidæ*	61
35.	(34)	Shell polished, shining—family *Eulimidæ*	63

PAGE

36. (19) Canal present—37.
37. (46) Canal notch-like—38.
38. (43) Aperture half or less than half length of shell—39.
39. (42) Aperture half length of shell—40.
40. (41) Shell plump, aperture wide—family *Nassariidæ* 65
41. (40) Shell fusiform, aperture narrow—family *Columbellidæ* 80
42. (39) Aperture less than half length of shell, shell slim, many-whorled—family *Cerithiidæ* 44
43. (38) Aperture more than half length of shell—44.
44. (45) Shell hairy—family *Trichotropidæ* 58
45. (44) Shell porcelanous—family *Olividæ* 83
46. (37) Canal slightly extended but may be closed—47.
47. (48) Periostricum covered with bristly hairs—family *Tritonidæ* 59
48. (47) Periostricum with no hairs—49.
49. (52) Canal short—50.
50. (51) Spiral sculpture predominant—family *Buccinidæ* 64
51. (50) Aperture wide—family *Purpuridæ* 75
52. (51) Aperture round, spire and canal moderately long — family *Muricidæ* 69

Family ACMÆIDÆ

Shells conical, tall or flattened. Apex of cone with no opening. Base oval and open. Not iridescent within. Muscle scar horseshoe-shaped and open in front.

These are odd little animals, clinging tenaciously to rocks, other shells, or kelp stalks. When the tide is in they creep about in search of plant material which constitutes their food, returning to their " home " perhaps with the aid of the slimy trail they leave. The feeding-organ is a flat ribbon set with rows of sharp horny teeth, an ideal arrangement for scraping off the seaweed.

Sexes in limpets are separate. No spiral form is evident even in the early stages. After hatching, the larva is at first free swimming; when it is ready to settle down, it grows its conical shell.

***Acmæa digitalis* Eschscholtz** **Fingered Limpet**

Description. — Shell with apex far forward and almost hooked. Ribs strong, rough, and radiating. Colour greyish with dark zigzag markings. Interior pale brownish toward centre and dark around the margin. Size about 1 inch in diameter.

Distribution. — Alaska to Mexico. Fairly common in Georgia Strait and along the coast, but not in the inlets. Abundant at Yakun Point, Queen Charlotte Islands.

Habitat.—On rocks where there is some surf and quite high on the beach, usually in a shaded area.

***Acmæa instabilis* (Gould)** **Unstable Limpet**

Description.— Apex somewhat forward of centre, height about one-third the length of the shell. Sides nearly straight, base inclined to be oblong, curved upward at the ends so that the shell rocks when set on a flat surface. Exterior brown with fine radiating lines. Interior light-coloured with a brown band around the edge. Size to 1 inch in diameter.

Distribution. — Alaska to California. In British Columbia: Sooke, Port Renfrew, Tofino, Cape Caution, Kyuquot.

Habitat. — Found on kelp stalks along the whole coast, but not at all common. Juveniles have been taken on setline in Jervis Inlet at about 40 fathoms.

Acmæa mitra **Eschscholtz** **Whitecap Limpet**

Description. — Shell cone-shaped, strong, high, and white in colour. Apex nearly central. Aperture oval; muscle scar horseshoe-shaped. Interior white. Often encrusted with pink corallines. Size about 1 to 1½ inches in diameter.

Distribution. — Alaska to California. Common on British Columbia coast.

Habitat. — Rocky beaches at low tide. Has been taken from deeper water on set-lines and other gear. Port John at 10 fathoms in salmon seine. Also Portland Canal at 10 fathoms.

Acmæa pelta **Eschscholtz** **Shield Limpet**

Description.—Shell conical with straight sides; apex slightly forward of centre. Outside white and dark brown striped or checkered. Inside bluish, usually with a dark patch on posterior slope; margin dark or with dark and light alternate markings. Sometimes this species is roughly ribbed as though one set of stripes had eroded. Size to 1½ inches in greatest diameter.

Distribution. — Alaska to Mexico. Common on the British Columbia coast.

Habitat.—Found on rocks; occasionally on some seaweeds. From the lowest low tide to the highest high but particularly above mid-tide.

***Acmæa persona* Eschscholtz** **Mask Limpet**

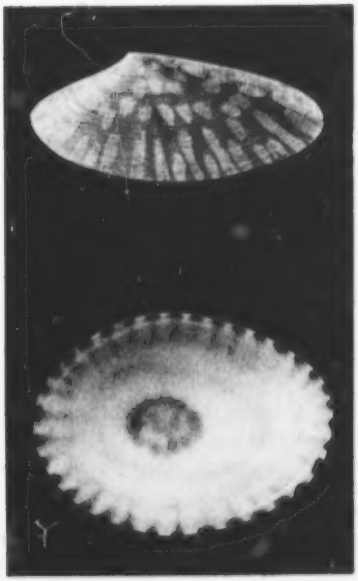
Description. — Apex well forward of centre. Slopes convex, especially the posterior, when viewed in profile. Outside mottled grey with brown or black. Inside bluish-white with dark border and usually with a dark stain behind the apex. Size to 1½ by 1¼ inches in diameter; ⅝ inch high.

Distribution. — Alaska to California. Quite common.

Habitat. — On rocks high on the beach, often where some fresh water seeps out and in the shade of overhanging trees or cliffs.

Notes.—The mask limpet is nocturnal in habit, as are most of the members of this family.

***Acmæa testudinalis scutum* Eschscholtz** **Plate Limpet**



Description. — Shell cone-shaped, low and flattened. Apex nearly central with fine radiating lines. Aperture a wide oval. Colour mottled greenish-grey outside. Inside bluish and shiny with dark marks around the border and usually a brown centre. Size to 2 inches in maximum diameter.

Distribution. — Alaska to California. Common in British Columbia.

Habitat. — On rocks high on beach. The shell is apt to be camouflaged with growths of green or brown algæ.

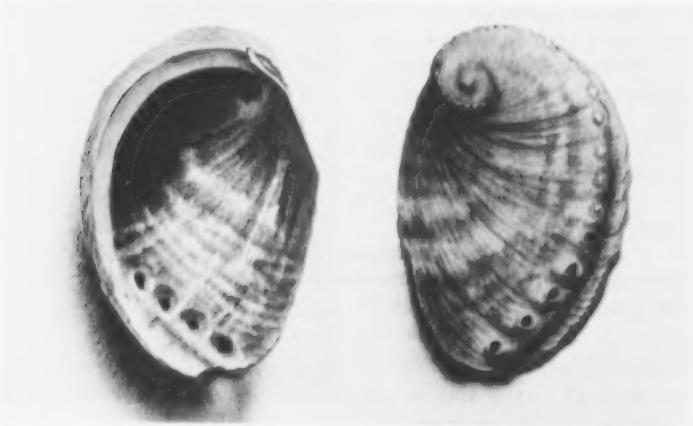
Notes. — This is the only limpet on the Pacific Coast with brown tentacles.

Family HALIOTIDÆ

The name of this family means "ear shell," but on the Pacific Coast the members are called abalones. They resemble the limpet in their habit of clinging to the rocks with a broad flat foot, but they differ in form. The typical shell is oval and flattened with corrugations over the surface and a low spire near the posterior end. The left edge is turned under and thickened; the other is thin and sharp. Above the thickened margin runs a row of holes, the earlier ones closed and the later ones open. Through these protrude organs whose function it is to pass out the water from the gills together with any waste material. The spawn is also discharged through these respiratory pores.

The animal is a vegetarian and lives on rocks where seaweeds abound. The shells often become encrusted with growths and are difficult to detect. They are also difficult to dislodge unless taken by surprise.

***Haliotis kamtschatkana* Jonas** **Northern Abalone**



Description.—Shell thin, with fairly high spire. Four or five respiratory holes open, each with a raised edge. Colour of outside reddish or mottled; inside, rainbow-hued mother-of-pearl. Length to 6 inches; smaller sizes more common.

Distribution.—Japan; Alaska to San Pedro, California. In British Columbia: Port Neville in Johnstone Strait and north to Alaska; Queen Charlotte Islands; west coast of Vancouver Island; Victoria; recently reported from Nanaimo, South Pender Island, Sidney, Ballenas Islands, and other areas in Georgia Strait. Single record from Egmont.

Habitat.—On rocky beaches in colonies at and below low-tide level to 6 fathoms. In Georgia Strait they are rarely intertidal. Abalones seem to favour surf-lashed rocks on exposed reefs, but they are sometimes found in numbers in more sheltered waters. They seem to congregate where pink coralline algæ thrive.

Notes.—It is interesting to watch these molluscs creeping about under water. Ordinarily their pace is slow, but they may move as much as 6 inches between surges, and if threatened by a predatory starfish they can travel with surprising speed.

When exposed on a dull damp day, they sometimes lift up and drop back with an audible snap.

We have only one species of *Haliotis* on the coast of British Columbia, and it is our most beautiful gastropod. The shell is too thin to be of use commercially, but the animal makes very good eating. The foot is sliced and lightly pounded before frying, and when properly prepared it is an excellent food item. A few are canned, but not regularly. There is now a small market for frozen whole abalones.

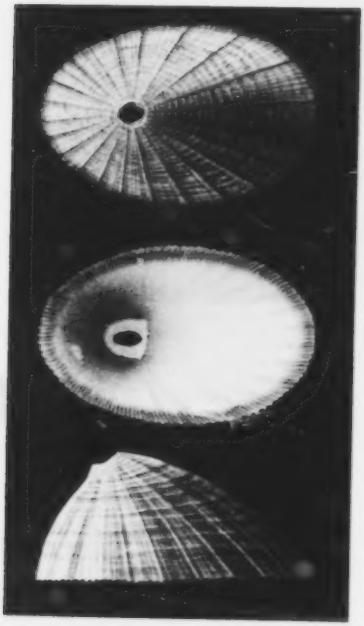
Regulations forbid the taking of abalones measuring less than 2½ inches across the shortest diameter of the shell.

FAMILY FISSURELLIDÆ

Closely related to the haliotids are the fissurellas or keyhole limpets. They have no spire, but they have a slit or opening at the apex corresponding to the row of holes in the abalone. In appearance and habits they are much like the true limpets—cone-shaped, clinging to rocks, and feeding on seaweeds.

Although there are several deep-water species, only two are likely to be found living intertidally.

Diodora aspera Eschscholtz — Rough Keyhole Limpet



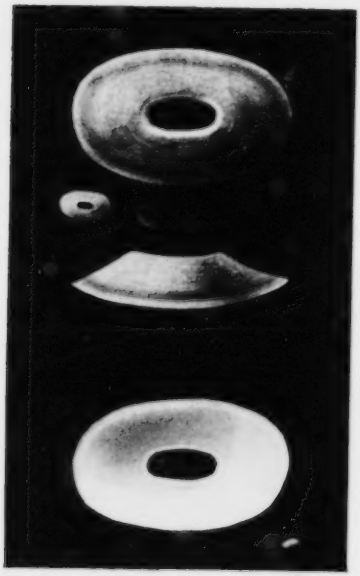
Description. — Shell conical, rather low and with a long oval base. Apex well forward of the centre. Apical opening nearly round. Slopes somewhat arched, especially the posterior. Numerous radiating ridges crossed by concentric lines give a rough netted texture to the surface. Edge of shell crenulated. Exterior often grey and drab but sometimes white with brown rays in attractive pattern. Interior white. Size to 2½ inches in maximum diameter.

Distribution. — Alaska to Lower California. In British Columbia: Common along the whole coast.

Habitat.—On rocky beaches at low-tide level. Brought up by skin divers from 8 fathoms, mouth of Sechelt Inlet.

Notes.—Inhabiting the mantle cavity of *Diodora aspera,* there is frequently to be found a specimen of the commensal scale worm, *Arctonoë vittata* (Grube). It rests on edge coiled round the mantle, sometimes so long that its ends nearly meet.

***Megatebennus bimaculatus* Dall** **Spotted Keyhole Limpet**

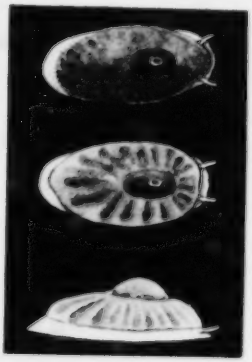


Description. — Shell conical, low and with an oval base. Apical hole long, narrow, oval; located centrally and about ⅓ length of shell. Sculpture similar to that in *Diodora* but more delicate. Colour grey or brownish with a darker ray on each side from the apex. Interior white with rays faintly visible through the shell. Edge distinctly crenulate. Size to ¾ inch in maximum diameter.

Distribution. — Alaska to Mexico. In British Columbia: Clayoquot, Tofino, Sooke.

Habitat. — Usually to be found on holdfasts of the large seaweeds along the south and west coasts of Vancouver Island. Sometimes in shallow water under stones. Has been dredged in 15 fathoms off the California coast.

Notes.—Although the shells do not vary much in colour, the animal may be red, yellow, or white. It is much larger than the shell, and the latter can be completely covered by the mantle.



FAMILY TROCHIDÆ

A family of herbivorous snails usually found on rocks amongst the seaweed. Mostly the shells are low conical in shape, pearly within, sometimes covered by a periostracum. The operculum is thin, horny, nearly circular, and multispiral. The aperture is round and entire.

***Tegula funebralis* (A. Adams)** **Black Top-shell**

Description.—Shell a low cone of four rounded whorls, often eroded at the apex. Body whorl with a fold next the suture; angled and somewhat flattened on the base. Colour purplish-black. Interior pearly with a black margin. Umbilicus completely closed; two teeth on the lower part of the columella. Size about 1 inch in diameter.

Distribution.—British Columbia (Queen Charlotte Sound) to Lower California. In British Columbia: Table Island, Cape Caution, Cape Scott, Quatsino Sound (Koprino Harbour), Long Beach, Muir Creek.

Habitat.—At mid-tide level to fairly high on rocky beaches.

Notes.—Black top-shells are rather uncommon near the northern limits of their range. Only a few have been collected on the shores facing Queen Charlotte Sound. They are more plentiful

along the west coast of Vancouver Island, such as at Long Beach, where they are found on rocky exposed beaches.

Top-shells are heavy and strongly built to withstand the force of the surf in rocky places. They are edible and compare favourably with the British winkles.

***Tegula pulligo* Gmelin** **Dusky Turban**

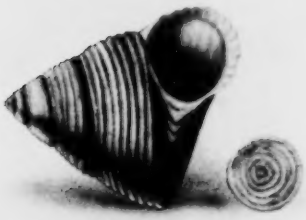
Description. — Shell with seven flattened whorls often encrusted with growths. Upper one or two usually eroded away on older specimens. Last whorl angulated and slightly convex below. Umbilicus wide open and umbilical region white. Colour brown with purplish mottlings; sometimes obliquely streaked with orange on the body whorl. Interior of shell pearly. Size to 1½ inches high.

Distribution. — Sitka, Alaska, to Lower California. Generally distributed along the coast of British Columbia but not in the Strait of Georgia.

Habitat. — Open rocky beaches from about the 10-foot level to below the lowest tide.

Notes. — Dusky turbans, like the black top-shells, prefer rocky shores. The former are much more common in British Columbia.

***Calliostoma ligatum* Gould** **Blue Top-shell**



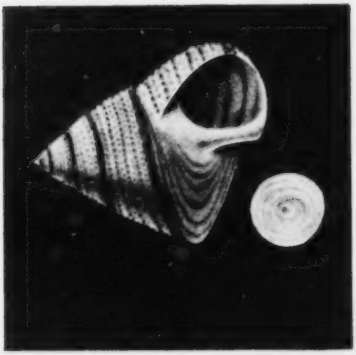
Description. — A little candy-striped top, more brown than blue and with whitish spiral ribs. Shell with about seven evenly rounded whorls. Columella widens into a callus which covers the umbilicus. Aperture round and interior pearly. Size to 1 inch in diameter.

Distribution. — Alaska to San Pedro, California. Generally distributed in British Columbia.

Habitat.—Very common on rocks and in crevices on rocky beaches. Dredged from 7 fathoms (Nahwitti Bar, Vancouver Island).

Notes.—When the outer coat is removed, the blue top-shell is indeed blue—nacreous and beautiful. Occasionally shells are found in the stomach of the lingcod with the periostracum already removed by the action of the stomach acid. Formerly known as *C. costatum* Martyn.

***Calliostoma annulatum* Humphrey** **Ringed Top-shell**

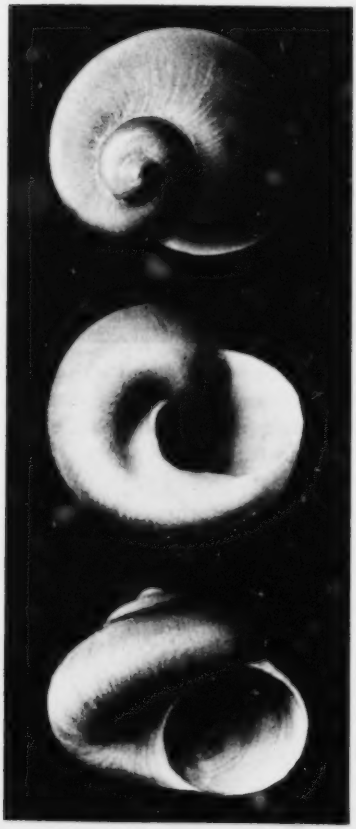


Description.—More fragile and more beautiful than *C. ligatum*. Shell almost a perfect cone with about eight flattened pale yellow whorls, each sculptured with spiral beaded ridges. Sutures outlined with band of bright purple; apex purple. Periphery of body whorl angular and base nearly flat. Outer lip thin and forming a sharp angle. Umbilicus filled and columella stained with purple. Height to 1¼ inches.

Distribution.—Forrester Island, Alaska, to San Pedro, California. Breakwater, Victoria, B.C.

Habitat. — An aristocrat among British Columbia snails, the ringed top-shell is not commonly found on the beach but sometimes on kelp around the south end of Vancouver Island. It is apparently an inhabitant of deeper water.

***Margarites helicinus* Phipps** **Smooth Margarite**

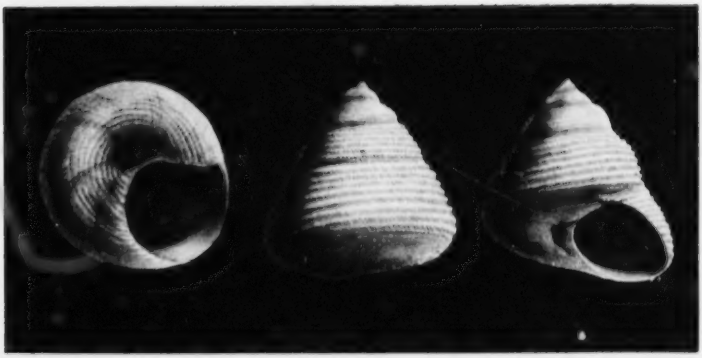


Description. — Shell with about five convex whorls; spire low and obtuse; suture distinct; aperture circular. Body whorl rounding into tiny umbilicus without an angle. Sculpture almost lacking. Colour iridescent, often pink but with greenish tones, sometimes quite dark. Operculum thin and round. Size about ⅓ inch in diameter.

Distribution.—Bering Strait to California. Greenland to Massachusetts. Northern Europe. In British Columbia: Table Island, Rivers Inlet, Burnaby Strait (Queen Charlotte Islands), Calvert Island, Alert Bay, Sechelt Narrows.

Habitat.—A deep-water species but often on the beach, especially on eelgrass or other marine vegetation.

***Margarites lirulatus* (Carpenter)** **Lirulate Margarite**

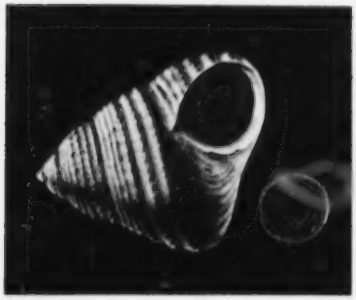


Description.—Shell very variable, turban-shaped and with about five whorls, with revolving liræ or nearly smooth. Suture distinct. Umbilicus rather slit-like. Aperture oblique. Base of body whorl convex. Colour pink or purplish, often with a silvery sheen. Interior pink and iridescent. Height to ½ inch.

Distribution.—Alaska to San Pedro, California. Widely distributed in British Columbia.

Habitat.—Common on sheltered rocky beaches. Also dredged from 5 fathoms (Ladysmith) and 10 fathoms (Percy Anchorage, B.C.)

Margarites pupillus (Gould) **Puppet Margarite**



Description.—Very similar to *M. lirulatus.* Distinguished by the angular periphery and flattened base of the body whorl. Height to ½ inch.

Distribution and Habitat.—Same as *M. lirulatus;* also taken in same dredging.

***Margarites succinctus* Carpenter** **Tucked Margarite**

Description.—Shell smaller than that of *M. helicinus*. About four or five whorls, apex low, fairly acute, suture impressed. Base flattened and somewhat angled around the funnel-shaped umbilicus. Sculpture of low spiral ribs. Colour greyish with rows of brownish blotches. Aperture slightly squared below. Pearly green within. Size about ¼ inch in diameter.

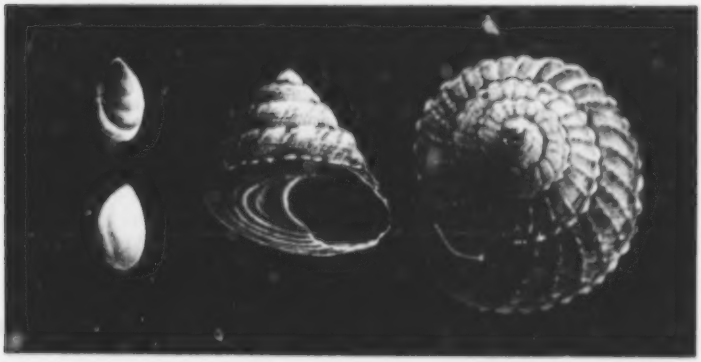
Distribution. — Alaska to Lower California. Effingham Island, B.C.

Habitat.—On algæ and eelgrass near the low-tide level.

FAMILY TURBINIDÆ

Herbivorous snails similar in shape to the members of the Trochus family but with a heavy calcareous operculum. The shell, too, is heavy and solid, usually with brilliant pearl beneath the periostracum and with a nacreous interior.

***Astræa gibberosa* Dillwyn** **Red Turban**



Description.—Shell a low, wide cone with a sharp apex (especially in juveniles or when not eroded); base flat. Whorls crossed diagonally by rough ribs, each constricted near its lower end, making a kind of beading. A scalloped or fluted ridge runs around periphery of the body whorl and follows spirally just above the suture to the apex. Base sculptured with coarse concentric furrows. Colour bright reddish where brown periostracum is worn away. Interior pale shining nacre, spreading over umbilical region but there covered with dull white. Operculum thick and heavy, white with a brownish suffusion toward one end; cemented to a thin brown corneous back. Size to 3 inches across base and 2¼ inches high.

Distribution.—Masset, B.C., to San Pedro, California. In British Columbia: Spider Island, Seaforth Channel, Milbanke and Laredo Sounds; west coast of Vancouver Island.

Habitat. — Rocky beaches, sheltered or open. Usually from 3-foot level to below low tide but occasionally as high as the 6-foot level.

Notes.—The operculum of this handsome gastropod is much like the " cat's-eye " of the Pacific and was at one time used by the Indians of British Columbia and Alaska as a personal ornament and in inlay work.

Better known as *A. inæqualis* Martyn.

***Homalopoma carpenteri* (Pilsbry)**

Carpenter Dwarf Turban

Description.—Shell with about four rounded whorls marked with many smooth spiral cords. Body whorl large. Apex low but sharp. Interior pearly, margin of lip red. Columella covered over with pearl, one or two low nodules at the base. Operculum calcareous, nearly round, white and pearly but with an inner layer, thin yellow, corneous. Colour pinkish-red to brownish-red. Size to ⅜ inch.

Distribution. — Alaska to Lower California. In British Columbia: West coast of Vancouver Island and northward but not in the Strait of Georgia.

Habitat.—This tiny solid turban usually inhabits fairly deep water, but it has been taken alive at low tide on rocks in Burnaby Strait (Queen Charlotte Islands), on Long Beach (Vancouver Island), and on the breakwater at Victoria. Empty shells are more easily found and are popular with hermit crabs.

Family LITTORINIDÆ

A family of small snails, each with a strong shell with few whorls. A horny operculum is present. The animals are herbivorous, rasping algæ off the rocks with a radula equipped with several hundred teeth.

The littorines or "periwinkles" are world-wide in distribution.

***Littorina sitkana* Philippi** **Sitka Littorine**

Description. — Shell small, firm, with about four full rounded whorls marked by many coarse spiral ridges. Colour brown, sometimes with paler bands, or with the body whorl a vivid orange. Aperture large, circular, about half the height of the shell. Interior brown or orange. Operculum circular with central nucleus. Size to ¾ inch in height.

Distribution. — Alaska to Puget Sound. Common all along the British Columbia coast.

Habitat. — On rocks, pilings, eelgrass, and kelp. From low-tide levels to very high on the beach.

Notes.—The colouring of the littorine seems to blend with the background on which it lives and is evidently a means of protection.

The foot is divided by a median line, and the animal moves by lifting first one half and then the other. A gland secretes slime.

Littorines are semi-aerial in habit, an adaptation enabling them to spend about half their time out of water. They will suffocate if submerged for too long a time.

***Littorina scutulata* Gould** **Checkered Littorine**

Description.—Shell more slender and pointed than that of *L. sitkana.* About four convex whorls; surface smooth and rather shiny when not eroded. Colour brown or black, often splotched with white. Aperture less than half the height of the shell; outer edge thin and sharp, interior purplish. Operculum with few whorls, nucleus to one side. Size ½ inch in height.

Distribution.—Alaska to California. Common in British Columbia.

Habitat.—On rocky shores much the same as *L. sitkana.*

Lacuna variegata **Carpenter** **Variegated Chink-shell**

Description. — Shell very small, plump, with about four whorls and with sharp apex. Pale brownish with lighter and darker bands; smooth and glossy. Periphery carinated. Aperture rounded, outer lip very thin and fragile. Interior brown. Umbilicus a wide chink alongside the columella. Periostracum thin and smooth. Operculum quite thin, nucleus near one edge. Size usually about ¼ inch in height.

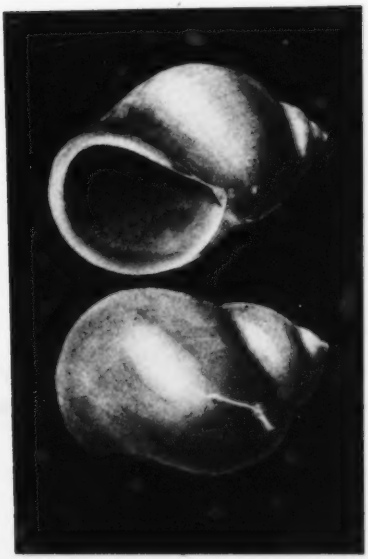
Distribution. — British Columbia to California. Common in British Columbia.

Habitat.—On eelgrass and seaweeds on rocky beaches.

Notes. — Chink-shells are entirely aquatic, hence are lower on the beach than littorines.

The light-yellow eggs are laid in tiny, gelatinous rings on kelp fronds. Each egg mass is less than ¼ inch across and contains many eggs.

***Lacuna carinata* Gould** **Wide Chink-shell**



Description. — Shell very similar to that of *L. variegata*. Spire less elevated, colour darker brown. Body whorl greatly enlarged. Aperture wide and flaring. Umbilical chink deep, conspicuous, and white in colour. Size ⅜ inch in height.

Distribution. — Bering Sea to California. Not very common in British Columbia: Lama Passage, Seaforth Channel, Tofino.

Habitat.—On kelp.

Notes.—Also known as *L. porrecta* Carpenter and *L. striata* Gabb.

FAMILY FOSSARIDÆ

Snails with small turban-shaped shells. Periostracum shaggy. Umbilicus open.

***Iselica obtusa laxa* Dall** **Obtuse or Blunt Iselica**

Description.—Shell similar to that of chink-shells. Whorls about four, convex; suture deeply impressed. Spire produced and acute. Sculpture a few shallow spiral grooves. Aperture rounded, columella arcuate and with a wide projection in the middle. Umbilicus a slit partly covered by the inner lip. Colour white; periostracum thin and rather shaggy, pale straw-coloured. Operculum brown and thin. Size 3/8 inch in height.

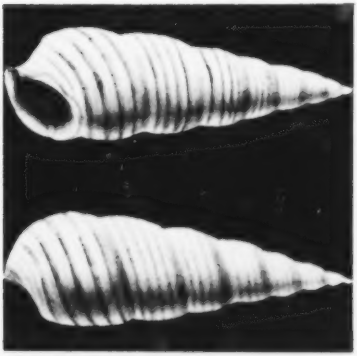
Distribution.—Vancouver Island to Puget Sound. Not common. McKenzie Bight (Saanich Inlet), Maple Bay, Burnaby Strait (Queen Charlotte Islands).

Habitat.—Shallow water on weeds and other shells. In jelly mass attached to little-neck clam (*Protothaca staminea*) at McKenzie Bight.

Family CERITHIIDÆ

Shell elongated with many whorls; tuberculated and sometimes varicose. Aperture small, canal short, anterior. Operculum circular and horny. Creeping animals found on rocky beaches and among seaweeds and other marine growths.

***Bittium eschrichtii* Middendorff** **Threaded Bittium**

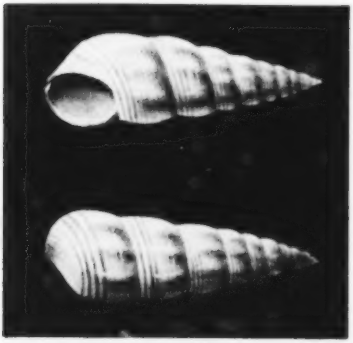


Description.—Shell turreted; whorls rounded; about nine gradually tapering to an acute apex. Nucleus of one white whorl (often eroded away). Whorls sculptured by four spiral keels and spiral lines crossed by coarse axial ridges. Periphery defined slightly by a spiral groove. Base with eight graduating spiral cords. Colour dull greyish-brown. Aperture oval, posterior angle obtuse, outer lip thin and wavy, canal very short, columella somewhat reflected. Operculum round with central nucleus. Size to ¾ inch in height.

Distribution. — Alaska to California. Generally distributed along the British Columbia coast.

Habitat.—Very common on rocky beaches at low tide; also in salt marshes, amongst algæ, and on oyster beds.

***Bittium attenuatum* Carpenter** **Slender Bittium**

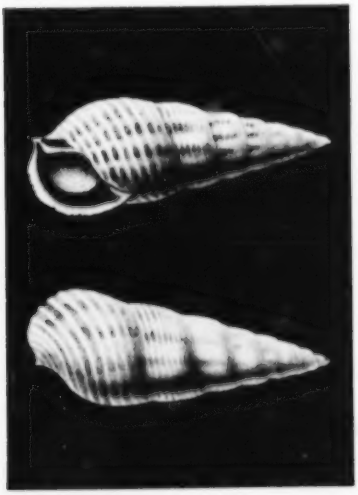


Description.—Shell smaller and slimmer than that of *B. eschrichtii*. Nucleus of two rounded smooth whorls. Later whorls sculptured by three spiral keels crossed by axial ribs giving a tuberculate appearance. Periphery marked by a spiral rib with groove above. Base short, bearing six spiral ribs, the first much larger than the rest. Colour white, grey, or brownish. Aperture oval, posterior angle acute, outer lip thin, sculpture showing within, canal very short, columella reflected. Size ½ inch in height.

Distribution.—Forrester Island (Alaska) to Lower California. In British Columbia: Egmont; Effingham Island; Hand Island; Sooke; Burnaby Strait and Naden Harbour (Queen Charlotte Islands).

Habitat. — Common on rocky beaches or amongst seaweed. Dredged to 35 fathoms.

Batillaria zonalis **(Brugière)** **Cuming's Batillaria**



Description.—Shell turreted; whorls slightly rounded, eight or nine in number. Apex acute. Whorls sculptured by five or six coarse spiral ribs crossed by about a dozen axial ridges making a sort of beading. Suture not well defined. Base with spiral cords but not ridges. Colour greyish with darker-brown "beads." Aperture rounded, canal very short, columella slightly reflected. Operculum horny, round, central nucleus, multispiral. Size to 1⅛ inches in height.

Distribution.—Japan, from about 40° N. to below equator. In British Columbia: Boundary Bay; Comox, Fanny Bay, Ladysmith, Crofton (Vancouver Island).

Habitat.—Sand or fairly firm muddy bottom, mostly about midpoint or higher in intertidal zone.

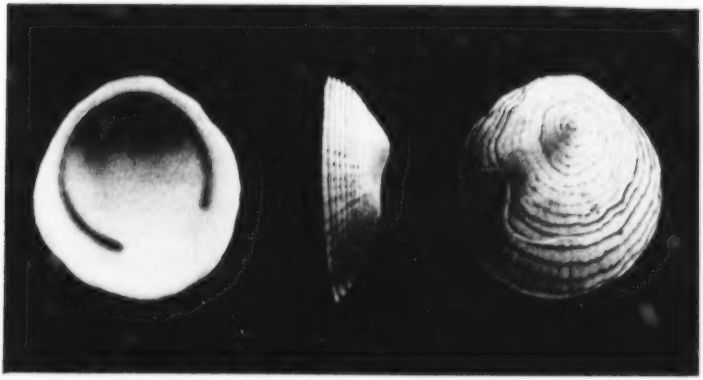
Notes.—Introduced with oyster spat from Japan. Since its distribution is limited to areas planted with oyster seed, the larvæ probably have a short pelagic period or none at all.

Also known as *Batillaria cumingi* (Grosse).

FAMILY HIPPONICIDÆ

Shells solid, heavy, somewhat limpet-like; apex hooked backward, not spiral. The animal secretes, between itself and the rock to which it is attached, a shelly plate, thereby fixing itself permanently. It probably feeds on plankton.

***Hipponix cranoides* Carpenter** **Flat Hoof-shell**



Description.—Shell small, flattened; roundish or irregular, depending on the shape of the site. Marked with concentric, axially striate, lamellæ. Apex low and to one side. Epidermis brown when young but usually missing in older specimens. Colour white outside and in. Prominent horseshoe-shaped muscle scar in interior. Size ½ to ¾ inch in diameter.

Distribution.—Queen Charlotte Islands to San Diego, California. In British Columbia: Graham Island (Queen Charlotte Islands; Nuchatlitz Inlet (Nootka Island); Clayoquot and Kyuquot (Vancouver Island).

Habitat.—On rocks at low tide.

Notes.—The shells are often covered with algæ and other organisms, rendering them difficult to see. Also known as *H. antiquatus* Linné.

***Hipponix tumens* Carpenter** **Sculptured Hoof-shell**

Description.—Shell more regular in shape than that of *H. cranoides*. Apex higher and definitely hooked, beak leaning far over on most specimens. Surface sculptured with coarse axial ribs and faint concentric markings. Colour pale creamy brown. Periostracum bearded with light-brown hairs. Interior less polished and muscle scar narrower and shallower than in *H. cranoides*. Size ¾ inch in diameter.

Habitat.—On rocks.

Notes.—Hitherto the recorded range of this species has not included British Columbia, but the finding of a single specimen at Table Island, north of Vancouver Island, indicates that it may be found elsewhere along the British Columbia coastline.

Family CALYPTRAEIDÆ

Shells limpet-shaped with spiral apex. Interior polished. Septum present, cup-shaped or deck-like. Contours vary according to rock or other shell on which animals have fastened, but they are more or less flattened with wide aperture and no operculum.

After settling down, these animals seldom move. They feed on seaweeds that come their way and occasionally on other molluscs.

Eggs are usually laid in capsules and protected by the foot until the young hatch and swim away.

***Calyptræa fastigiata* Gould** **Chinese Hat Snail**

Description. — Shell circular, low, conical; apex central; spire composed of three tiny whorls (to be seen with a lens). Colour white with a thin pale tan epidermis. Interior white and glossy with a spirally twisted deck running from the apex to near the margin of the shell. Size about ¾ inch in diameter but occasionally over an inch by ⅝ inch high.

Distribution. — Alaska to California. In British Columbia: Johnstone Strait, Rivers Inlet, Victoria, Departure Bay, Percy Anchorage; dredged from 10 fathoms in the latter two places.

Habitat.—Usually in fairly deep water but may be found at low tide from Johnstone Strait north and on the west coast of Vancouver Island. On rocks, other snails, floating kelp, or attached to crabs.

***Crepidula adunca* Sowerby** **Hooked Slipper-shell**

Description. — Shell small, round, margin wavy or fluted as determined by the object to which it is attached. Highly arched to a recurving hook or beak, very sharp in young snails, overhanging the posterior edge. Colour dark brown with yellow periostracum. In older specimens, outer surface often encrusted with bryozoans, etc. Interior like smooth brown porcelain. White deck across almost half the cavity. Space above it deep and open up into the apex. Size about ¾ to 1 inch in diameter.

Distribution.—Queen Charlotte Islands to Lower California. Hotspring Island, Graham Island (Queen Charlotte Islands); Table and Calvert Islands; Rivers Inlet; Kyuquot, Long Beach, and Victoria (Vancouver Island).

Habitat. — Shallow water, on rocks or other shells. Common on *Tegula pulligo* and *Calliostoma ligatum;* often on one another.

***Crepidula lingulata* Gould** **Wrinkled Slipper-shell**

Description. — Shell low and irregularly round; apex near one edge. Colour white with yellowish periostracum, often partially worn off or obscured by encrustations. Interior also white or blotched with brown. White triangular-shaped deck, attached along one side, ridged down the middle. Size to 1 inch in diameter.

Distribution.—Bering Sea to Panama. Very common along the coast of British Columbia.

Habitat.—On rocks and on living gastropods.

***Crepidula nummaria* Gould** **White Slipper-shell**

Description. — Shell thick and coarse or thin and delicate; with or without a heavy yellow periostracum. Sometimes quite round but varying to long and narrow. Marked with faint or heavy concentric ridges. Apex sharp and marginal. Dull white outside, glistening white inside. Deck also white, large, usually with a sinuous edge. If the shell is flat, the deck is arched to make room above for the animal. Size to 1½ inches in diameter.

Distribution. — Alaska to Panama. Fairly common in British Columbia: Table Island, Seaforth Channel, Blackfish Sound, Savary Island, Barkley Sound, Sooke, Victoria breakwater, Jervis Inlet (40 fathoms), Okisollo Channel (60 fathoms).

Habitat.—Shallow to very deep water on rocks and dead shells.

Notes.—White slipper-shells are often found living in the apertures of shells (particularly *Tegula* and *Polinices*) inhabited by hermit crabs. In such cases the epidermis is all or partially worn off and the adult size is determined by the size of the abode. The larger ones are females. Smaller ones are usually males, which change to females in from 4 to 6 months.

There is some doubt as to whether all *Crepidula nummaria* are one species; some day the problem may be solved.

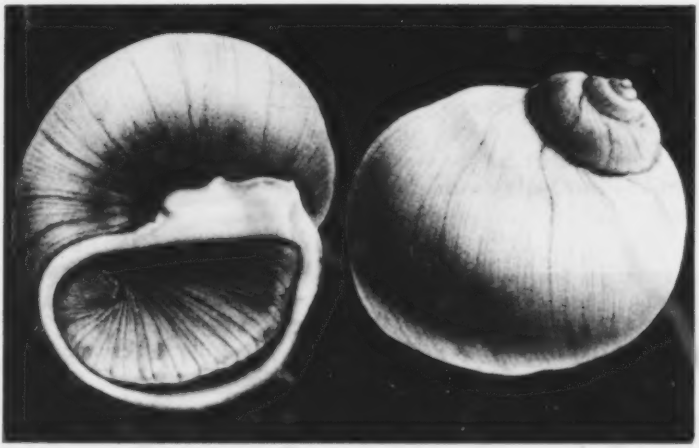
FAMILY NATICIDÆ

Shells round or globular with the body whorl greatly enlarged. Spire low. Aperture wide and rounded. Canal wanting. Operculum horny or calcareous.

The animal is carnivorous, attacking bivalves by drilling a hole in the shell.

The foot is well developed for burrowing, and it is so large it would seem impossible for the owner to draw it into the shell.

***Polinices lewisii* Gould** **Lewis Moon-snail**



Description.—Shell large and globose. Whorls about six, with the body whorl comprising most of the shell. Spire low and fairly sharp. Body whorl with faint wide spiral constriction part way down. Some wrinkling and flattening in front of the suture, especially on the last whorl. (In some specimens this is very pronounced, and in such cases the spire is noticeably lower in proportion to the size of the aperture.) Aperture wide and flaring with smooth outer lip and columella. Umbilicus open. Colour of shell yellowish with a thin brown periostracum. Interior mottled brown and white or

cream and overlaid with a polished white finish. Operculum horny, dark brown with a spiral nucleus near one edge. Size to 5 inches in height, occasionally more.

Distribution.—Masset, B.C., to Lower California. Common on sandy or gravelly beaches.

Habitat.—Sandy, gravelly, or muddy flats in shallow water and down to 25 fathoms.

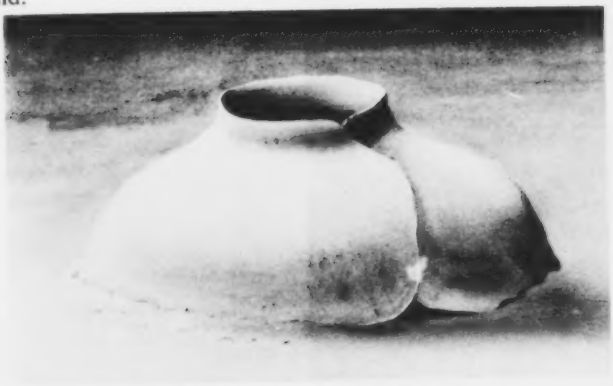
Notes.—The moon-snail is noted not only for its large round shell, but also for its extremely large fleshy foot. When fully expanded, it is many times bigger than the shell, but it can be contracted by ejecting small streams of water from perforations around the edge so that the foot can be completely stowed away within the shell.

In feeding, the foot is clamped around the prey while the radula, aided by an enzyme secreted by a gland on the proboscis, drills a countersunk hole through the shell, permitting the insertion of the radula. On clam beds these predators may be very destructive. Since they burrow just below the surface, they can often be located by poking into a smooth low hump on the beach.

The egg case or "sand-collar" has been mentioned in the introduction. It is evidently shaped around the shell or the foot. A layer of eggs is concealed between two layers of sand held together by a mucous secretion. The eggs hatch in midsummer, and

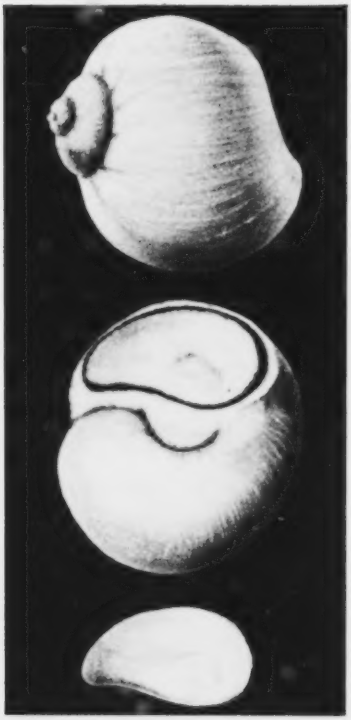
the larvæ have a free-swimming period. Small specimens are obtained only with a dredge.

The Lewis moon-snail is sometimes named *Lunatia lewisi* Gould.



Sand-collar of moon-snail.

***Natica clausa* Broderip and Sowerby** **Bull's-eye**



Description.—Shell like that of the moon-snail but much smaller and lacking the constriction on the body whorl. A bit flattened but not wrinkled at the suture. Colour pale yellowish or tan, sometimes lighter on the base. Epidermis thin and pale brown. Distinguished from the moon-snail by the smooth white callus filling the umbilicus and by the calcareous operculum, which is white, hard, shiny, and slightly concave. Size to 1½ inches in height.

Distribution.—The Arctic Ocean to Southern California. On the east coast, Arctic Ocean to North Carolina. Northern Europe. In British Columbia: Skincuttle Inlet (Queen Charlotte Islands); Egmont Reef; Jervis Inlet (8 and 40 fathoms); Departure Bay (10 fathoms).

Habitat.—Usually this species is taken in deep water or sometimes from fish stomachs. It has been dug occasionally both on the flat inside Sechelt Rapids at the mouth of Sechelt Inlet and on the reef outside. Probably it is on other beaches where the water is cold. It seems to dwell deeper in the sand than does the moon-snail.

Notes.—Instead of being smooth, the surface of the sand-collar is sprinkled with tiny protuberances—the egg cases in which the young develop.

FAMILY LAMELLARIIDÆ

Snails resembling a sea slug, each with a small delicate shell enclosed by the mantle. Shell with low spire and very large body whorl. Aperture wide. Canal and operculum wanting. Most are inhabitants of cold water.

***Velutina lævigata* Linnæus** — **Velvet Shell**

Description.—Shell round, with about three whorls. Spire very low, suture distinct; body whorl many times larger than spire. Colour pinkish under a thin velvety brown periostracum, the latter showing spiral ridges. Aperture very wide and nearly circular. Interior white with the brown showing through. Size to ¾ inch in height.

Distribution. — Circumboreal. Labrador to Massachusetts. Arctic Ocean to California. In British Columbia: Egmont Reef; Long Beach, Victoria breakwater, Ladysmith (Vancouver Island).

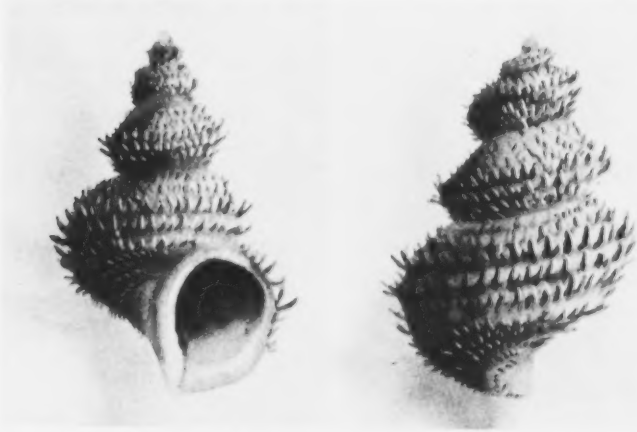
Habitat.—A cold-water species found on rocks at low tide. Dredged from 3 to 15 fathoms and from as deep as 50 fathoms farther south.

Notes.—Having no operculum, this little fellow clings flat to a rock limpet-fashion. However, it is thought to be carnivorous, probably feeding on small invertebrates such as hydrozoans, compound ascidians, and similar animals. As a means of protection, velvet shells have the ability to exude quantities of frothy white slime.

FAMILY TRICHOTROPIDÆ

Carnivorous snails with a small thin shell. Spire short and sharp. Whorls carinated; umbilicus inconspicuous. Periostracum hairy. Operculum horny, smaller than aperture, laminæ elliptical, nucleus lateral.

***Trichotropis cancellata* Hinds** **Checkered Hairy Snail**



Description.—Shell with six or seven whorls; spire very acute and almost as long as body whorl. Whole shell marked by sharp spiral cords and finer concentric ridges, giving it the cancellate appearance from which it gets its name. Colour yellowish-white covered by a yellow periostracum set with rows of bristly hairs growing along the cords. Umbilicus covered by inner lip. Aperture wide and rounded, fragile at the outer lip, ending abruptly in a very short canal. Interior white or tinged with yellow. Size 1 inch in height.

Distribution.—Bering Sea to Oregon. In British Columbia: Sechelt Narrows, Seaforth Channel, Rivers Inlet, Blackfish Sound, Ladysmith (5 fathoms), Percy Anchorage (10 fathoms).

Habitat.—Rocky shores where water is cold. Dredged to 25 fathoms.

FAMILY TRITONIDÆ

Carnivorous snails, each with a thick, strong shell with a long or short canal. Spire usually as long as, or longer than, the aperture. Whorls provided with varices, but these are sometimes inconspicuous until the heavy epidermis is removed. The operculum is horny.

Many species come into shallow water to spawn. The larvæ are pelagic, and in some cases species have become very widely distributed, even from ocean to ocean.

Fusitriton oregonensis **(Redfield)** **Oregon Triton**

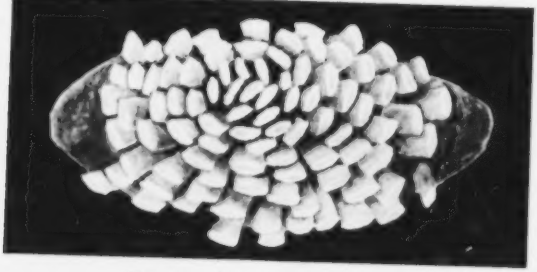
Description. — Shell large, with six or seven convex whorls marked by numerous low varices. Varices crossed by spiral ridges. Colour white. Periostracum straw-coloured, covered with close spiral rows of dark-brown bristles. Aperture wide, curving abruptly into an open canal. Operculum heavy, dark brown, chitinous, with nucleus near one end. Size 3 to 5 inches in height and 2 inches in diameter.

Distribution. — Bering Sea to San Diego, California. British Columbia: Laredo Sound; Milbanke Sound; Hakai Pass; Lasqueti Island; Jervis Inlet; Port Neville, Victoria (Vancouver Island). Common.

Habitat. — Tritons are frequently taken on set-lines and in shrimp traps in fairly deep water. Presumably they frequent rocky bottom since the apex is usually worn, especially in the larger (older) shells. Occasionally they have been found at low tide,

probably when they have come in to spawn (breakwater at Victoria, pilings at Port Neville, beaches on Fisher Channel).

Notes.—The egg cases of the Oregon Triton have been described in an earlier section. Each case contains a number of eggs which hatch into larvæ that turn cannibalistic while still within the capsule. The few survivors that eventually emerge swim for a time, using a pair of lateral flaps to propel themselves. Finally they settle down and spend the balance of their lives in a more prosaic manner.



Egg capsules of Oregon Triton.

FAMILY PYRAMIDELLIDÆ

Small snails with conical or pyramidal shells of many whorls. Nucleus sinistral but later whorls dextral. Columella usually with a fold or plait. Operculum paucispiral, nucleus apical.

The members of this and the following family, Eulimidæ, are sucking animals with neither radula nor jaws but with a well-developed proboscis. They are often commensal or parasitic on echinoderms, polychæte worms, and other animals.

Such miniatures as these may well be overlooked. Although it is almost impossible for the amateur to identify them beyond the genus, it is interesting and rewarding when careful search turns up a colony of them amongst the worm cases on a rock or on a large shell.

Odostomia quadræ Dall — Odostome

Description. — Shell very small, base oval; spire conical, longer than aperture. Whorls about five, slightly rounded and shouldered, sutures deep. Fine sculpture lines of growth and fine spiral striations. Colour opaque white. Aperture oval, outer lip thin, an oblique fold on the curved inner lip. Umbilicus narrow. Size to ¼ inch in height.

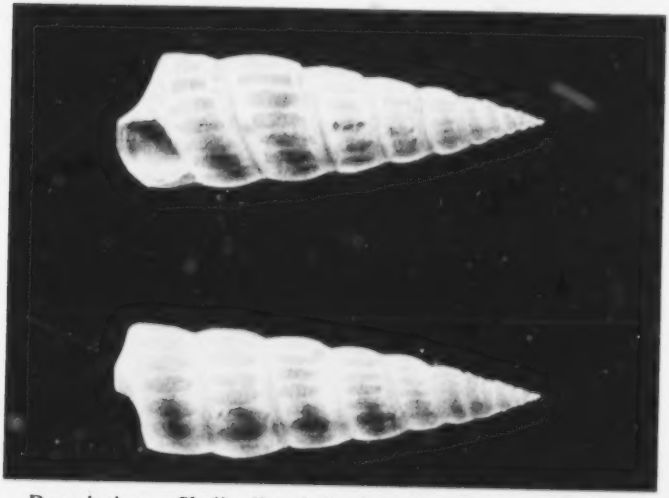
Distribution. — Cook Inlet (Alaska) to Puget Sound.

Habitat. — On polyps or sponges, and amongst worm cases at low tide.

Notes.—The odostomes are probably parasitic, obtaining nourishment by sucking juice directly from their host. They have been collected from a variety of hosts, including the purple-hinged rock scallop (*Hinnites multirugosus*) (reef near Sechelt Narrows).

Turbonilla eschscholtzi **Dall and Bartsch**

Eschscholtz Turbonilla



Description.—Shell tall and slender. Whorls about 10. Nuclear whorls decollated. Entire shell sculptured with fine spiral lines and prominent low axial ribs. Colour brown with faint darker bands on body whorl. Periphery somewhat angled. Aperture squarish. Outer lip thin. Columella with no folds. Size ¼ to ½ inch in height.

Distribution.—Forrester Island (Alaska) to Puget Sound. British Columbia: Sechelt Narrows; Brandon Island (Departure Bay, Vancouver Island).

Habitat.—More often dredged, but it has been taken at low tide on a reef near Sechelt Narrows.

Family EULIMIDÆ

Small snails with slender, nearly transparent shells of many whorls. Shells white, polished, often with the spire bent.

As has been mentioned, members of this family are mostly parasitic, the animals clinging to the host by means of a sucker. Some live within the digestive tract of sea-cucumbers.

***Eulima rutila* Carpenter** **Red Melanella**

Description.—Shell minute, with about eight rather flattened whorls, last one narrow and elongated, the others forming a straight spire. Practically no sculpture. Colour rosy white, beautifully polished. Aperture fairly large, oval, outer lip thin, extended between base and posterior angle. Inner lip short and curved. Foot well developed and operculate. Size to ¼ inch in height.

Distribution.—Alaska to Lower California. British Columbia: Jervis Inlet and Departure Bay (dredged from 8 fathoms), Sechelt Narrows (at low tide).

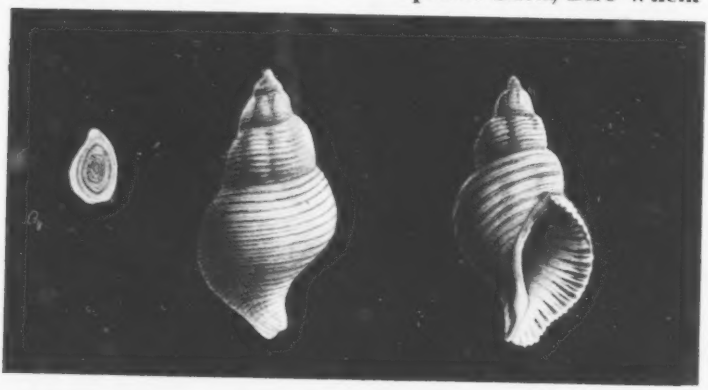
Habitat.—On sea-urchins, sea-cucumbers, and starfish at low-tide level and below.

Family BUCCINIDÆ

Moderately large snails; shell heavy. Aperture and body whorl also large. Canal generally short, sometimes only a notch at the base. Operculum horny, nucleus at the apex.

The animals are carnivorous but inclined to be scavengers.

***Searlesia dira* Reeve** **Spindle Shell, Dire Whelk**



Description.—Shell spindle-shaped, marked with conspicuous spiral threads. Upper whorls crossed by about nine low rounded ribs. Spire acute, half the length of the shell. Colour dark brownish-grey. Aperture serrated along the outer edge, the threads of the shell showing as grooves inside. Interior and columella brown and shining. Canal short and twisted to the left. Umbilical slit usually present. Operculum thin and horny, nucleus typically apical. Size to 1½ inches in height.

Distribution.—Alaska to California. Common along the coast of British Columbia.

Habitat.—Rocky beaches at low-tide level and below.

Notes.—Spindle shells are sometimes taken in deep water in shrimp traps and on set-lines.

FAMILY NASSARIIDÆ

Size not very large. Shell strong. Shell ovoid with pointed spire and short canal. Columella usually with a callus. Operculum claw-shaped with nucleus on one edge.

The broad foot has two slender appendages which leave a characteristic track in the sand, leading the searcher to the mound where the animal is buried.

The animals are carnivorous, either drilling clams or snails for live food or contenting themselves with dead flesh.

***Nassarius fossatus* Gould** **Channeled Dog Whelk**

Description.—Shell plump; spire sharp, longer than aperture. Whorls seven, upper ones and about one-third of the last one marked by axial ribs and spiral ridges, resulting in a granulated appearance. Lower part of last whorl with spiral ridges only. Deep fossa or groove around the base. Canal very short and abruptly reflected. Outer lip thickened and rather uneven. Columella curved and covered by a broad callus, yellowish to bright orange in colour. Balance of shell grey and brownish. Interior of aperture brown, edge yellow or orange, ribs visible. Size 1½ to 2 inches in height.

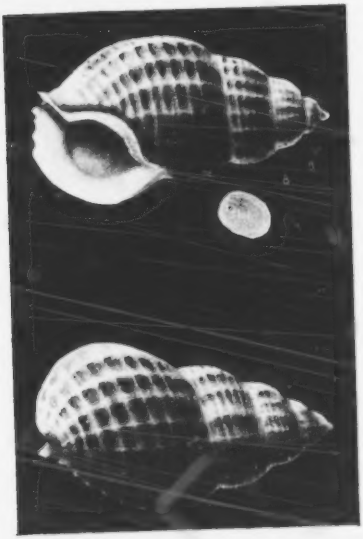
Distribution.—Queen Charlotte Islands to Lower California. British Columbia: Masset (Queen Charlotte Islands); Tofino, Clayoquot, Port Renfrew (Vancouver Island). Common.

Habitat.—Around or under rocks in sand or mud at low tide. Dredged off California.

Notes.—The channeled dog whelk, the largest member of the genus, can be trapped with decaying meat or fish for bait. The foot is wrapped around the food until it is devoured. The animal burrows in search of prey, travelling with the siphon or breathing-tube protruding above the surface. At other times the siphon apparently rests in the fossa.

When about to lay its eggs, the whelk first cleans with the radula a suitable spot on the rocks. One by one the flattened egg capsules are deposited and cemented in place, each overlapping the one before. As many as 45 capsules may be laid in one string.

***Nassarius mendicus* Gould** **Lean Dog Whelk**



Description.—Shell smaller than that of *N. fossatus*, much slimmer; spire proportionately longer. Similar markings with a beading formed by fine spiral lines, crossed by ridges from apex to the fossa around the base of last whorl. About seven rather rounded whorls. Apex sharp. Aperture about one-third the length of the shell, ovate, ribs showing within, outer lip thin. Columella curved with a thin white callus. Colour greyish, epidermis brown, interior white. Size to 1 inch in height.

Distribution. — Alaska to Lower California. Very common and widely distributed in British Columbia.

Habitat.—Rocky beaches at low tide. Dredged to 10 fathoms (Ladysmith, Percy Anchorage, Jervis Inlet) and taken from still deeper water in shrimp traps and on set-lines.

***Nassarius obsoletus* Say**

Black Dog Whelk, Eastern Mud Nassa

Description. — Shell short and plump. Apex sharp, usually eroded. Surface nearly smooth, sculptured only with faint spiral lines and fainter lines of growth. Aperture about half the length of the shell, narrower than in either *N. fossatus* or *N. mendicus*. Outer lip thin and simple with about six small teeth or ridges within. Canal just a notch. Colour rusty black. Interior and columella purplish-brown. Size 1 inch in height.

Distribution.—British Columbia to California. Nova Scotia to Florida on east coast. In British Columbia: Boundary Bay.

Habitat.—Mud flats, often where the water is brackish.

Notes.—This species has been introduced with oyster spat from the east coast. At present in British Columbia it seems to be confined to the Boundary Bay area, in soft muddy habitats. Although predatory at times, the black dog whelk is also a scavenger and seems to do no harm on the oyster beds here.

The animal is dull and mottled, and this together with the drab colour of the shell and the sand or mud which adhere make very good camouflage.

The egg capsules are laid in spring on eelgrass, in the inside of a moon-snail collar, or on an old bivalve shell. Large numbers are deposited very close together. Each capsule is spiny and transparent, attached by a short stalk.

FAMILY MURICIDÆ

Rock snails with heavy solid shells, usually ornamented with spines or varices. Spire and canal each of moderate length. Aperture inclined to be round and with a smooth enamel lining. Operculum horny, nucleus apical.

Rock snails are carnivorous. With a rocking motion and the use of the radula, the borer rasps a hole in the victim's shell and then sucks out the meat. The tooth so often present on the outer lip may be used as a lever when opening bivalves.

Sexes are separate. Eggs are laid in tough strong capsules, and some species are said to stand guard over them during incubation. And well they might, for they are apt to be eaten by members of their own family as well as by other kinds of snails. Inside the capsule the young are cannibalistic, too; the lone survivor emerging finally, presumably fat and healthy.

***Ceratostoma foliata* (Gmelin)** **Leafy Hornmouth**

Description.—Shell fairly large and strong; distinguished by three wide lamellated varices running from the apex obliquely down

the shell, the last one terminating in a flattened closed canal. Canal of the previous varix still visible, although closed completely and unused. Whorls marked by prominent spiral ribs which continue to the edges of the varices, giving them a fluted appearance. Aperture fairly large. Columella simple, outer lip conforming to the flutings of the last varix and with a sharp tooth or spine near the base. Colour greyish-white with yellow or brown on the body whorl; sometimes the latter and the last or two last varices are all a rich chestnut. Interior white. Operculum horny with nucleus on one edge. No periostracum. Size to 3½ inches but commonly under 3 inches in height.

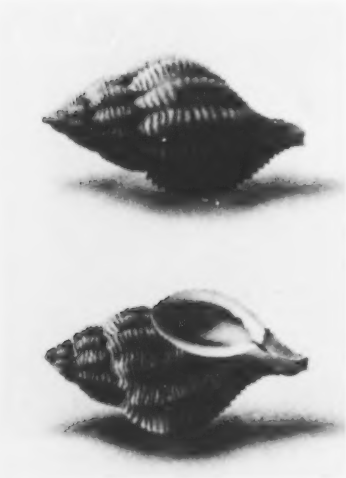
Distribution.—Sitka, Alaska, to San Diego, California. Common in British Columbia.

Habitat.—Rocky beaches. Dredged to 35 fathoms.

Notes.—Good specimens of this rather handsome species are not common as the apex is often eroded. In juveniles the varices may be lacking and the canal may be open slightly.

The yellow lily-shaped egg cases are frequently deposited on the animal's own shell. Each capsule contains about 25 eggs.

***Ocenebra lurida* (Middendorff)** **Lurid Rock Shell**

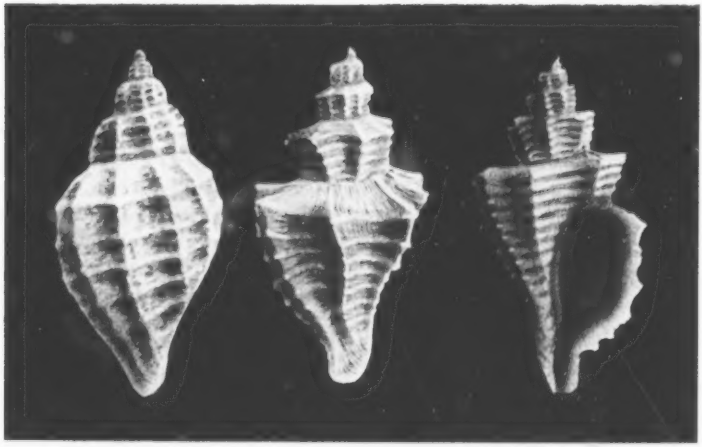


Description. — Shell solid, spindle-shaped; spire somewhat produced. Canal short, open or partially closed. Whorls about six, rounded, sculptured with fine close spiral threads and crossed by low transverse ridges from the apex to the periphery of the body whorl. Aperture oval; columella nearly straight, six or seven small teeth inside the outer lip. Colour of shell pale yellowish to dark brown or red. Interior white with perhaps a blotch of colour. Operculum small, brown and pointed; periostracum thin and furry. Size 1¼ inches in height, more often 1 inch.

Distribution. — Alaska to California. In British Columbia: West coast of Vancouver Island, Sooke, Esquimalt, Victoria (breakwater), Sansum Narrows.

Habitat.—Rocky beaches at the low-tide level.

***Ocenebra interfossa* Carpenter** **Sculptured Rock Shell**

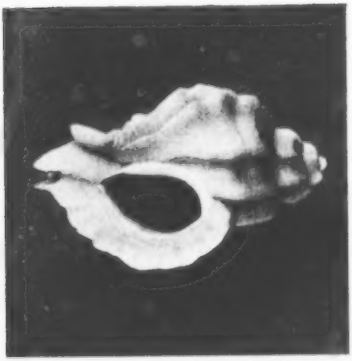


Description.—Shell spindle-shaped, usually drab and unattractive. Spire produced and sharp, about half the length of the shell. Aperture small, canal short, open or closed. Surface sculptured by about 8 to 11 coarse ribs crossed by strong spiral cords together producing a basket-weave effect. Shoulders angled. Colour dull grey, occasionally yellow. Interior white or yellow. There is considerable variation in this species. Size ¾ inch in height.

Distribution.—Alaska to Lower California. British Columbia: Common on Vancouver Island (Maple Bay, Victoria, Esquimalt); Burnaby Strait (Queen Charlotte Islands); Effingham Island; Jervis Inlet (deep water).

Habitat.—Common on rocky beaches at low-tide levels and to moderate depths.

Ocenebra japonica (Dunker)
Japan Rock Shell, Japanese Oyster Drill



Description.— Shell solid-looking. Whorls about five or six, each with about eight low transverse ribs and faint spiral lines, some more like raised threads. Suture distinct and shoulders slightly tabled. Aperture oval, columella barely reflected, outer lip thin in young specimens but thickened in adults. Canal rather short and open in the early stages of growth; usually closed later. Colour ranges from white to yellow and brown; inside of aperture brown or yellow. Operculum light brown. No periostracum. Size 1½ inches in height.

Distribution.—Japan and North China. British Columbia: Ladysmith Harbour; Boundary Bay; a few specimens from Comox, Crofton, Thetis Island, and Sooke.

Habitat.—Rocky beaches, especially on oyster beds.

Notes.—This drill was introduced into Puget Sound and British Columbia waters with oyster spat from Japan and has been fairly abundant in Ladysmith Harbour since about 1935 and in Boundary Bay since about 1942. It does considerable damage on the oyster beds, but as it does not have a pelagic larva, it has not spread of its own accord. Care must be taken not to carry it along when moving oysters from an infested locality to one free of the pest.

***Urosalpinx cinerea* Say** **Eastern Oyster Drill**

Description. — Shell coarse and solid. Whorls five or six, rounded. Sculpture of spiral lines crossed by about 10 vertical folds. Apex acute. Suture distinct. Colour grey, yellow, or brown; body whorl sometimes lighter than spire. Aperture oval, outer lip thin, canal short. Interior purple or brown. Operculum horny. Size to 1 inch.

Distribution.—Atlantic Coast, Nova Scotia to Florida. In British Columbia: Boundary Bay only.

Habitat.—Intertidal and down to 4 or 5 fathoms.

Notes.—The eastern oyster drill was introduced to British Columbia with oysters from the Atlantic Coast. In late years the numbers have decreased, and it is not so serious a pest as the Japanese drill (*Ocenebra*).

During spawning the animals move in-shore. The capsules are vase-shaped and each contains 8 to 12 eggs.

FAMILY PURPURIDÆ

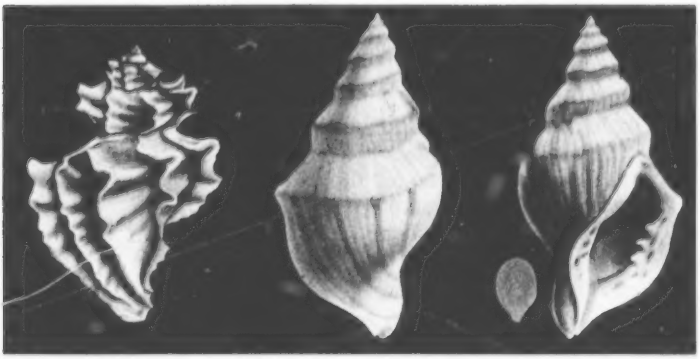
Whelks with thick heavy shells, having short spires, enlarged body whorl, wide aperture, and a short canal. Operculum horny.

They are closely related to Murexes; some authorities include them in family Muricidæ.

The animals are carnivorous, feeding on ascidians, clams, oysters, barnacles, and sometimes on their own eggs. In some cases the snail secretes a milky fluid which seems to drug the prey.

The "purples" get their name from a purplish fluid which is secreted by the mucous gland. The ancient Romans obtained their "Tyrian purple" from a species of *Murex* in the Mediterranean, but the Indians of West Central America learned to dye their cotton with the fluid from live *Purpura*.

***Thais lamellosa* Gmelin** **Wrinkled Purple**

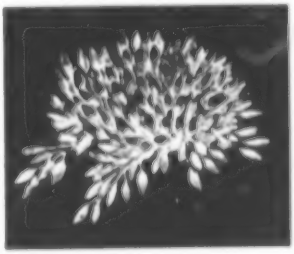


Description.—Shell extremely variable. In exposed locations it is very thick and nearly smooth, while in sheltered places it may be beautifully ornamented with up to a dozen transverse frills. The spire, especially in the smooth forms, may be quite short, but in others it is as long as the aperture and canal. The whorls are marked by spiral ridges, sometimes angled at the shoulder. Aperture wide with more or less pronounced tooth-like projections inside

the outer lip. Columella straight, canal short. No umbilicus. Colour from white, through yellow, orange, purple, and brown, plain or with contrasting bands. Inside whitish but often with some colour showing through. Operculum with nucleus on one side. Size 1½ to 3 inches in height.

Distribution.—Bering Strait to California. Common along the British Columbia coast.

Habitat.—Rocky beaches, in both sheltered and exposed locations.



Notes.—The wrinkled purple is probably the most common and most variable whelk in the intertidal zone in British Columbia. The breeding season is in the winter, at which time these snails congregate more than usual at about the low-tide level. The vase-shaped yellow egg cases are attached to the undersides of rocks and are known locally as "sea oats."

Thais emarginata **Deshayes**

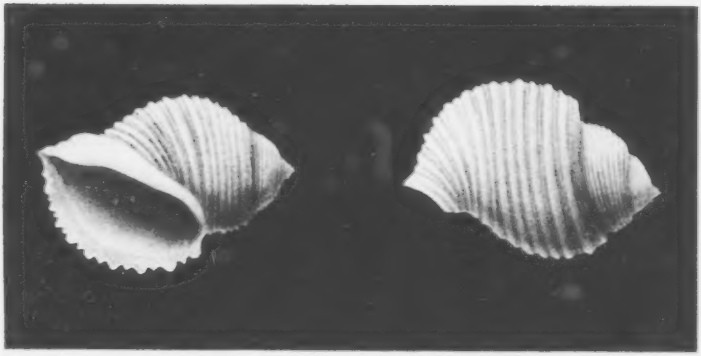
Short-spired Purple, Rock-dwelling Thais

Description. — Shell quite variable, usually short and plump, with a low spire of about three whorls, sometimes obtuse and sometimes very acute; body whorl greatly enlarged and expanded. Sculpture of strong spiral ribs, usually a large and small one alternating and often with coarse nodules. Aperture wide, outer lip thin; columella arched and flattened; canal very short and slightly recurved. Or the whole shell may be thick, more elongated and nearly smooth, with a narrower aperture. Colour from a dirty grey to black, brown, or yellow, often with white bands on the ribs. Operculum dark brown with nucleus low and on one side. Size about 1 inch in height.

Distribution. — Bering Sea to Mexico. Widely spread in British Columbia.

Habitat. — Rocky beaches but not in protected inlets.

***Thais lima* Gmelin** **Rough Purple**

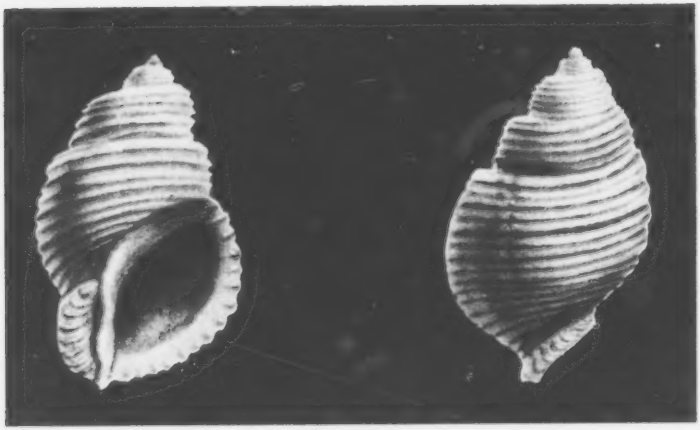


Description.—Shell more slender and elongated than that of *T. emarginata*. About five whorls; spire nearly half the length of the shell, tapering to a sharp apex. Body whorl large, sutures distinct. Sculpture finer than in *T. emarginata,* made up of alternate large and small spiral cords quite close together, and rough but not nodulose. Aperture fairly wide; outer lip thin and crenulate. Colour from white to brown, sometimes in bands. Interior white with some colour showing through. Columella flattened, canal short and slightly recurved. No umbilicus. Operculum very similar to that of preceding species. Size 1 to 2 inches in height.

Distribution. — Arctic Ocean to Lower California. Japan. British Columbia: Masset, Burnaby Strait (Queen Charlotte Islands); Calvert Island; Table Island; Long Beach, Victoria (Vancouver Island).

Habitat. — Rocky beaches at low-tide levels and into deeper water.

***Thais canaliculata* Duclos** **Channeled Purple**



Description.—Shell very similar to that of *T. lima,* and since each varies considerably they are apt to be difficult to distinguish. However, *T. canaliculata* has a more constricted suture and more pronounced spiral cords; the grooves between are deeper and rarely there is a faint low thread in the groove. Size about 1 inch in height.

Distribution.—Aleutians to California. Not common in British Columbia: Fisher Channel, Table Island, Cape Scott.

Habitat.—Rocky beaches.

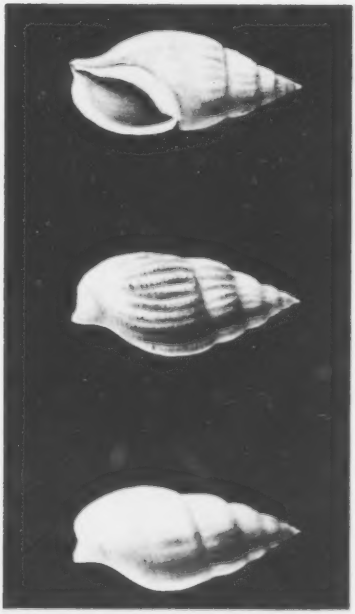
FAMILY COLUMBELLIDÆ

Snails with fusiform shells. Spire produced, aperture narrow, canal short. Columella arched and crenulated or toothed. Outer lip usually thickened and rather straight in the middle portion. Epidermis present. Operculum horny.

The members of this family are carnivorous and seemingly of a gregarious nature.

Some species have the ability to spin a thread and may be found dangling from a kelp or seaweed or possibly from the surface of the water in a tidal pool.

Amphissa columbiana Dall — Wrinkled Amphissa



Description. — Shell with numerous fine longitudinal ridges running from apex to about half-way down the body whorl. Also a close thread-like spiral sculpture. Whorls seven; spire about same length as aperture and quite acute. Aperture almost rectilinear; outer lip often but not always thickened; inner lip slightly reflected and covered with smooth enamel. Canal a short wide notch. Colour from pink or mauve to yellow and frequently mottled with brown. Epidermis thin and fawn-coloured. Size 1 inch in height.

Distribution. — Alaska to California. Very common in British Columbia.

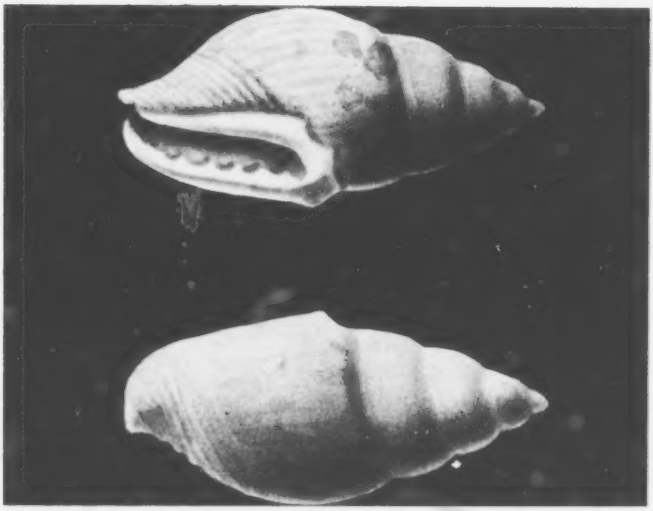
Habitat. — Rocky beaches at low tide. Mud bottom in 16 fathoms off California.

Notes. — Shells of juveniles are usually thin and delicate

looking, while those of older specimens are inclined to be thick and encrusted with growths.

The common name derives from the presence of many longitudinal ridges on the shell.

***Mitrella gausapata* Gould** **Dove Shell**



Description.—Shell small and smooth, the only sculpture a few faint lines near the base. About six or seven flattened whorls. Suture distinct. Aperture less than half the length of the shell, narrow outer lip, usually thickened and with several teeth inside. Canal just a notch. Epidermis yellowish-brown with darker markings underneath. Interior and columella brown. Size ¼ inch in height.

Distribution.—Alaska to San Diego, California. Common in British Columbia.

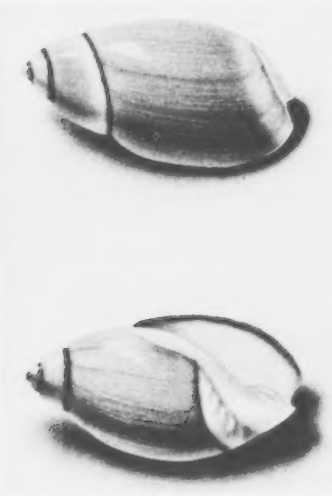
Habitat.—Around the roots of eelgrass or on algæ-covered rocks. Dredged from 5 fathoms at Ladysmith.

FAMILY OLIVIDÆ

Members of this family derive their name from their resemblance to the olive fruit. The body whorl is greatly enlarged and the aperture is long and narrow. Surface porcelain-like and polished, protected from abrasion by two wide lobes of the mantle. Suture canaliculated. *Olivella* has a tiny horny operculum, but the true *Oliva* has none.

The animal is burrowing, ploughing along just under the surface, leaving a little furrow on top, by which its presence may be detected. It is carnivorous. *Olivella* has tentacles but no eyes.

Olivella biplicata Sowerby — Purple Olive



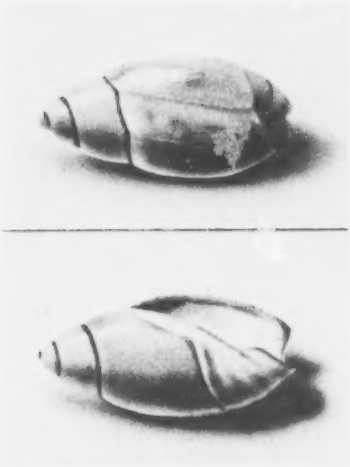
Description.—Shell shiny, globose, mostly body whorl, with sharp short spire. Colour sometimes nearly white but varying through lavender-grey to dark purplish, usually with brown markings. Aperture very long with outer lip thin and inner smooth and white. Canal a mere notch. Two folds on the columella. Size about 1 inch in height.

Distribution.—Sitka, Alaska to Lower California. British Columbia: Masset (Queen Charlotte Islands); west coast of Vancouver Island from Cape Scott to Juan de Fuca Strait.

Habitat.—Sandy beaches.

Notes.—Purple olives were at one time used by the Indians of the south as a medium of exchange.

***Olivella bætica* Carpenter** **Little Olive**



Description.—Shell shiny, globose, somewhat like that of the purple olive, but much smaller and slimmer in proportion, with the thickest part of the body whorl below the middle. Spire more elevated. Aperture only a little over half the height of the shell, outer lip thin and canal a notch. Colour creamy with reddish-brown markings and often with purple or brown bands around the lower part of each whorl. Size ¾ inch in height.

Distribution.—Alaska to Lower California. British Columbia: Masset (Queen Charlotte Islands); Queen Charlotte Sound; west coast of Vancouver Island; Juan de Fuca Strait; Georgia Strait.

Habitat.—Sandy beaches and sometimes from deeper water; off Banks Island (34 fathoms); Goletas Channel (25 fathoms); Scuttle Bay (10 fathoms).

Notes.—The Queen Charlotte Sound records are based on shells recovered from stomachs of starfish taken on halibut gear.

FAMILY MARGINELLIDÆ

A family of small species, mostly tropical. Shell porcellaneous and shining, rather pear-shaped; spire short or covered by the greatly enlarged body whorl. Aperture narrow and the full length of the shell. Columella plaited.

Foot large, generally with no operculum. Mantle folded back over the shell.

***Cyprœolina pyriformis* Carpenter** **Pear-shaped Marginella**

Description.—Shell minute, pear-shaped. The body whorl conceals the spire and the narrow aperture is as long as the shell. Outer lip thickened and bearing microscopic teeth. Four plaits on the columella. Colour white, sometimes with a tinge of orange, but nearly transparent so that the black animal shows through. No periostracum. Mantle protects the polished shell. Size ⅛ inch in height.

Distribution.—Alaska to Gulf of California. Common in British Columbia: Alert Bay, Savary Island, Sechelt Narrows, Victoria, Sooke.

Habitat.—At low-tide level to a depth of 40 fathoms. On mud or gravel, in rock crevices, on the backs of larger shells, and occasionally on kelp.

FAMILY ACTEONIDÆ

Small snails with a cylindrical shell. Spire short but sharp; aperture elongated. Columella with one fold. Operculum corneous with few whorls.

Animals of this and next three families are hermaphroditic. The body partially envelopes the shell when crawling, but it can be completely withdrawn. The dorsal surface of the head forms a disk for burrowing.

Acteocina culcitella Gould — Pillowed Lathe-shell

Description.—Shell very slender. Whorls about five, the last enlarged. Spire short, suture deep and rather channeled. Aperture very narrow, rounded below; outer lip thin, columella with a fold at the base. Sculpture fine striæ. Colour white beneath a thin yellow epidermis. Size to 1 inch but commonly much smaller.

Distribution.—Kodiak Island (Alaska) to California. British Columbia: Clayoquot, Victoria, Egmont Reef.

Habitat.—On rocks at low-tide level. Dredged at 8 fathoms (Jervis Inlet and Departure Bay).

Acteocina eximia Baird **Excellent Lathe-shell**

Description. — Shell cylindrical but less flattened on the sides of the body whorl than that of the pillowed lathe-shell. Spire depressed; aperture long, wider anteriorly. Outer lip thin, columella curved abruptly at the base. Shell white. Periostracum yellow touched with orange. Surface covered with close wavy striæ. Size ½ inch in height.

Distribution. — Alaska to California. British Columbia: Egmont Reef, Sechelt Narrows.

Habitat. — More often dredged but found occasionally on the beach at low tide.

Acteon punctocœlatus **Carpenter** **Barrel Shell**

Description. — Shell small, barrel-shaped. Spire short and body whorl enlarged. Aperture more than half the length of the shell; outer lip thin and slightly crenulate inside. Columella curved and with one pronounced fold. Sculpture of close-set spiral ribs. Colour white with wide black or brown spiral bands. Body of animal white. Size ¾ inch in height.

Distribution.— British Columbia to California. Egmont, Crofton.

Habitat. — Usually below low-tide level, but sometimes in tide pools and amongst the eelgrass at low water apparently when it comes in to spawn. Large numbers were seen quite low on a more or less sandy beach in the mouth of Sechelt Inlet in May.

FAMILY SCAPHANDRIDÆ

Shells similar to those in the family *Acteonidæ*, mostly looking as if they had been rolled up. Spire greatly reduced. No operculum.

Animals carnivorous, burrowing in sand or mud in search of prey.

***Cylichna attonsa* Carpenter** **Slim Cup Shell**

Description. — Shell cylindrical, much like that of *A. eximia* but with straight sides. Spire depressed and concealed. Outer lip projecting above apex. Callus forms a sort of fold on columella, and there is another fold below. Colour white. Periostracum brown. Size ½ inch in height.

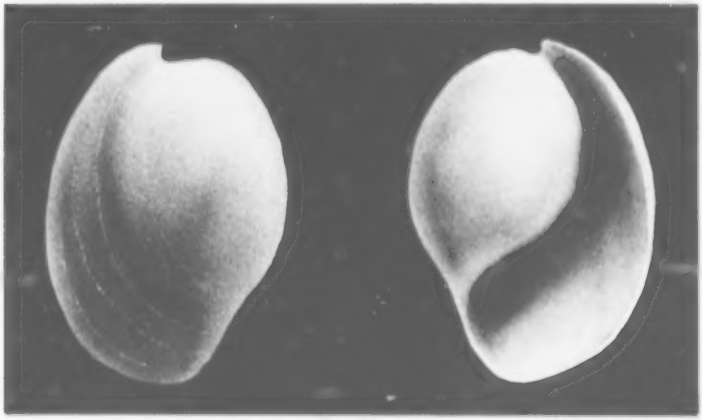
Distribution. — British Columbia to California. Sechelt Narrows.

Habitat.—This, also, is a deep-water species, but it is occasionally found on rocks where the water is very cold.

FAMILY BULLIDÆ

Delicate-looking snails, each with a glassy fragile shell incapable of containing the entire animal. Spire reduced and body whorl very large. No operculum.

***Haminæa vesicula* Gould** **White Bubble Shell**



Description.—Shell nearly transparent, animal extending over it to such an extent that only the animal is visible. Mostly body whorl, ovoid in shape; spire sunken, aperture projecting well above the summit; narrow above, widely flaring below. Outer lip thin. Columella arcuate with a narrow callus. Colour not actually white but pale greenish covered by a very thin periostracum. Size ¾ inch in height.

Distribution.—Alaska to Gulf of California. Common in British Columbia.

Habitat.—Muddy bays, amongst eelgrass, in sandy or gravelly patches between rocks. Sometimes where water is brackish.

Notes.—Alive on the beach this little bubble shell looks more like a globular bit of dark-brown jelly. It is very difficult to extract the animal without breaking the shell.

The snail is partially vegetarian, but it also eats small crustaceans and molluscs, grinding them up in a gizzard equipped with plates or teeth.

Mucus is secreted to keep the animal moist when not submerged.

Eggs are laid on eelgrass and look like little coils of narrow ribbon.

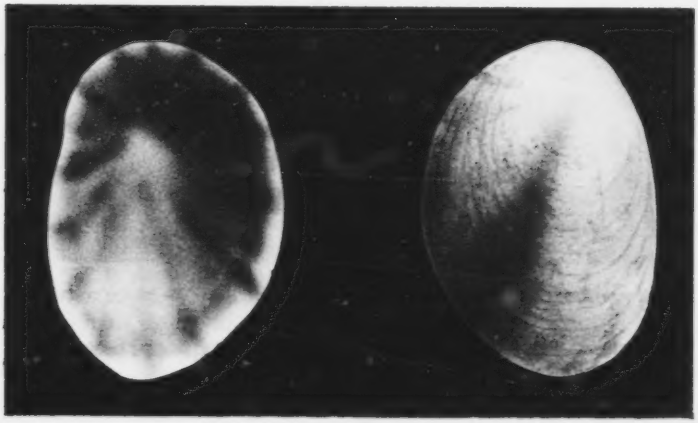
Living bubble shell.

FAMILY SIPHONARIIDÆ

Flattened snails, each with a limpet-shaped shell distinguished from that of the true limpets by the muscle scar which, although it is horseshoe-shaped, opens on one side (the animal's right) instead of at the anterior end of the shell. Running through this opening from the apex to the margin is a deep or shallow siphonal groove.

This family of marine snails is classed with the aquatic pulmonates. They are amphibious, having both lungs and gills. They frequent rocky shores just below high tide and are hermaphroditic. There is no free-swimming larval stage.

***Siphonaria thersites* Carpenter** **Siphon Shell**



Description.—Shell limpet-like, low, conical. Apex forward and toward one side. Muscle scar not very distinct but opening to the right. Siphonal groove, causing the margin to look a bit wavy. Dark brown, horny, and shiny inside and out. No operculum in the adult. Size to 1¼ inches maximum diameter.

Distribution.—Aleutian Islands to Puget Sound. Table Island, Vancouver Island.

Habitat.—Rocky ocean beaches.

ACKNOWLEDGMENT

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(NOTE.—The following publications are not all concerned directly with the univalves of the North-west Coast of America, but they have all been referred to in the preparation of this manual.)

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GLOSSARY OF TERMS

Angulated—formed with an angle, as when the body whorl has a sharp angle around the widest part or periphery.
Anterior—forward or head end; opposite to apex.
Aperture—the opening in the shell from which the animal protrudes.
Apex—tip of the spire.
Apical—at the apex.
Arcuate—arched or bent like a bow.
Axial—from the apex parallel with axis of shell.
Base—under part of body whorl.
Bivalve—a mollusc with the shell in two parts.
Calcareous—composed of carbonate of lime.
Callus—a deposit of enamel.
Canal—a trough-like extension of the margin of the aperture to contain the siphon.
Cancellate—sculpture lines crossing at right angles.
Carinated—with a keel or sharp ridge.
Carnivorous—flesh-eaters.
Chitinous—made of a hard, horny substance.
Columella—central pillar of a gastropod shell.
Commensal—living together and sharing food.
Constriction—a contraction or very shallow groove.
Corneous—horny.
Crenulated—minutely scalloped.
Deck—a thin flattish projection inside the aperture of some limpet-like shells.
Decollated—apex (nucleus) fallen off and tip sealed to keep out air.
Dextral—opening on the right side when the shell is held with the apex up and aperture facing toward the viewer.
Dorsal—on or toward the back.
Entire—aperture unbroken by canal or notch.
Epidermis—*see* periostracum.
Fossa—a deep groove.
Fusiform—spindle-shaped.
Gastropod—" belly-footed "; a member of the snail group, usually with a coiled shell.
Genera—plural of genus.

Genus—group of species with certain common characteristics.
Globose—like a sphere.
Herbivorous—eating plants.
Hermaphroditic—male and female reproductive organs in one animal.
Lamellæ—scales, frills, thin plates.
Liræ—fine lines or ridges.
Mantle—soft outer envelope of mollusc which secretes the shell.
Nacre—the inner layer of shell ("mother-of-pearl").
Nodules—rounded projections.
Nucleus—embryonic whorls of shell.
Nudibranch—a marine gastropod without a shell in the adult stage.
Operculum—shelly or horny plate attached to the foot for the purpose of closing the aperture of a shell.
Ovoid—oval; egg-shaped.
Paucispiral—with few whorls or volutions.
Pelagic—living in the open sea; drifting.
Periostracum—skin covering the shell.
Periphery—an imaginary line around the widest or outermost part of the body whorl.
Posterior—the hind end of the body or that nearest the apex of the shell.
Proboscis—a prolongation of the head often containing the mouth.
Radula—a ribbon-like organ bearing teeth used for rasping.
Recurving—turning backward, as the apex toward posterior margin.
Reflected—turned backward.
Septum—deck; flat internal process to which the muscle of the snail is attached in some limpet-like shells.
Sinistral—opening on the left when the shell is held with the apex up and the aperture facing toward the viewer.
Siphon—a tubular structure in the mantle through which water enters and leaves the gill cavity.
Species—a group of closely related individuals.
Spire—whorls above the body whorl.
Striate—marked with fine lines.
Suture—spiral line where one whorl joins another.
Tabled—flattened along the upper part of the whorl next to the suture.

Tentacles—sensitive elongated structures on the head.
Transverse—at right angles to the axis of the shell.
Tuberculated—covered with small tubercles or projections.
Umbilicus—a hollow at the base of the axis of the shell.
Varicose—bearing varices.
Varix—a prominent ridge indicating a former lip; plural is *varices*.
Ventral—lower or under side.
Whorl—one complete turn or volution of spire.

GLOSSARY OF APPROXIMATE MEANINGS OF SCIENTIFIC NAMES

Acmæa—entire, no indentations.
Acteon—a huntsman.
Adunca—hooked.
Amphissa—double or round about.
Annulatum—ringed.
Antiquatus—old.
Aspera—rough.
Astræa—starry.
Attenuatum—weakened or reduced.
Attonsa—sheared or clipped.
Bætica—slim, small.
Bimaculatus—two spotted.
Biplicata—double folded.
Callio/stoma—more beautiful; mouth or opening.
Cancellata—lattice work.
Canaliculata—channeled.
Carinata—keeled.
Carpenteri—after P. P. Carpenter, a noted taxonomist of molluscs.
Cerato/stoma—horned; mouth.
Clausa—closed space.
Columbiana—of British Columbia.
Cran/oides—helmet-like.
Culcitella—a small cup.
Cylichna—a cup or little box.
Cypr/æolina—Venus; changeable.
Digitalis—pertaining to a finger or toe.
Diodora—with a passage through.
Diva—ill-omened.
Emarginata—without a border.
Eu/lima—true; rasp or file.
Eximia—uncommon.
Fastigiata—exalted.
Foliata—leafy.
Fossatus—pierced.
Funebralis—funereal (probably referring to the dark colour).
Fusi/triton—spindle (shaped); demigod of the sea.
Gaus/apata—crooked; illusion.
Gibberosa—hunched.
Hali/otus—of the sea; ear.
Haminæa—hooked.
Helicinus—twisted.
Hipp/onix—horse; hoof.
Homalo/poma—smooth; cover.
Inter/fossa—between; ditch.
Instabilis—unstable.
Is/elica—like; stature.
Japonica—of Japan.
Kamtschatkana—of Kamtschatka.
Lacuna—pitted or hollowed out.
Lævigata—slippery, smooth.
Lamellosa—thinly layered.
Laxa—loose.
Lewisii—after Captain Meriwether Lewis of the Lewis and Clark expedition.
Ligatum—with bands.
Lima—rasp or file.

Lirulatus—ridged.
Littorina—belonging to the seashore.
Lurida—pale yellow.
Margarites—a pearl.
Mega/tebennus—large; robe or toga (referring to the mantle covering the shell).
Mendicus.—beggarly, needy.
Mitra—headdress or cap.
Mitrella—headdress or cap.
Nassarius—like a narrow-necked fish basket.
Natica—swimmer.
Nummaria—like money.
Obsoletus—without clear markings.
Obtusa—blunt.
Odo/stomia—way; mouth.
Olivella—like a little olive.
Oregonensis—of Oregon.
Pelta—a small shield.
Persona—a mask.
Polinices—a mythological name.
Porrecta—projected, extended.
Pulligo—dark-coloured.
Puncto/cælatus—spotted; carved in relief.
Pupillus—doll-like.
Pyriformis—pear-shaped.
Quadræ—fourfold.
Rutila—reddened.
Scutulata—checkered.
Scutum—an oblong shield.
Siphon/aria—tube; like.
Sitkana—of Sitka.
Striata—striped.
Succinctus—short or tucked up.
Tegula—a roof or covering.
Testudinalis—like a tortoise.
Thais—celebrated courtesan of Athens.
Thersites—the audacious, reviling one.
Tricho/tropis—hairy; keel.
Turbonilla—cone-shaped.
Variegata—changing.
Velutina—velvety.
Vesicula—a little bladder.

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